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Excavations at
GU ACHI

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A Reappraisal of Hohokam Settlement and Subsistence in the Arizona Papagueria

National Park Service / U.S. Department of the Interior

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Excavations at
GU ACHI

A

B

BUREAU OF AMERICAN ETHNOLOGY NO.
WILLIAM DINWIDDIE, PHOTOGRAPHER

Papago house and ramada in northern Sonora, 1894. Photograph by William Dinwiddie, Bureau of American Ethnology (Courtesy of the Arizona State Museum, no. 9179).

EXCAVATIONS AT GU ACHI

A Reappraisal of Hohokam Settlement and Subsistence
in the Arizona Papagueria

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C

FOREWORD

The National Park Service became involved in archeological research on the Papago Indian Reservation as a result of a special relationship between the Bureau of Indian Affairs and the National Park Service. Having no expertise in archeology, the Bureau of Indian Affairs turned to the National Park Service to provide assistance in this area. This relationship was established in 1966 by Chapter 501 DM 1 of the Departmental Manual.

In the early 1970's the National Park Service was providing such assistance to the Phoenix Area Office, Bureau of Indian Affairs, on the Papago and Gila River Indian Reservations. The Division of External Archeological Programs at the Western Archeological Center in Tucson, Arizona, was responsible for this program. At that time, Garland Gordon was the Division Chief. He had a deep interest in the program and took an active part. In fact, the program owed its existence to his strong support.

I began my National Park Service career as field supervisor of the excavation project at the Gu Achi and Pisinimo sites. When I assumed these duties the project was well underway, temporarily under the supervision of Dana Isham. Isham had established the datum, gridded the sites, and initiated excavation. Isham had the project running smoothly when I assumed responsibility. I appreciated the advantage of this good start. He made another significant contribution when, late in the field season, he assumed full responsibility for the testing of the site at Pisinimo.

This project was begun long before the Advisory Council on Historic Preservation guidelines (Title 36 CFR 800) were published. It was a salvage project typical of the 1960's and early 1970's. Road construction caught up with us long before our work was completed.

Vernon Palmer, Area Road Engineer, Phoenix Area Office, Bureau of Indian Affairs, instructed the contractor to avoid the site. As a result of Palmer's understanding and timely action, we were able to complete our work. The project would not have been completed without the funding provided by the Bureau of Indian Affairs or without the support of the Area Engineer. Vernon Palmer was and continues to be a strong supporter of historic preservation.

As the field work for this project came to an end, the activity we now frequently refer to as cultural resource management took off. Largely as a result of this, I was prevented from continuing the Gu Achi project. Instead I had to turn my efforts toward meeting the increasing number of requests for assistance we were receiving from the Bureau of Indian Affairs. With the creation of Interagency Archeological Services, I assumed yet more duties as Chief of the Division of External Archeological Programs. This took me even further away from the Gu Achi Project. I realized the project would have to be completed by someone else.

I selected Bruce Masse, a Ph. D. student at the University of Arizona. Masse developed the project far beyond my expectations. He has produced not only a site report, but a comprehensive synthesis of work in the Papagueria. I very much appreciate his effort and hope this work proves valuable to others dealing with the archeology of the Papagueria or southern Arizona.

A special thanks is in order for Dr. Emil Haury. During the field work I regularly met with Doc to discuss the project. His door was always open and he was never too busy to see me or Masse. Later Doc visited the site with us. Dr. Haury's interest and help with the project are deeply appreciated.

It is with a sigh of relief and a feeling of satisfaction that after seven years I finally see this work off to the printer. It is the result of work by numerous people. I can claim credit only for these few remarks.

John B. Clonts
Tucson, Arizona
1980

ACKNOWLEDGEMENTS

The Gu Achi Project would never have been successfully completed without the contributions and sacrifices of many individuals. Words can never be found to properly express my debt to these people.

John B. Clonts of the Western Archeological Center can be singled out as the person most directly responsible for this volume. It was only because of his unwavering belief that the site of Gu Achi merited detailed study that this volume was even written at all. Also, his encouragement, patience, guidance and his perseverance in all aspects of this study were greatly appreciated during my analysis and writing of the Gu Achi volume. I hope that this volume has fulfilled his expectations.

Two other individuals at the Western Archeological Center have also substantially enhanced this volume. Paulette H. Coulter, as editor, took a rambling, somewhat structureless narrative and fashioned it into a coherent and I believe meaningful discussion of the Hohokam in the Papagueria. Paulette forced me to realize that the English language is based on (more or less) logical rules, and even more importantly that things archeological can be written in simple English. Ellyn Bober shouldered the burden of typing the many drafts of this volume, including the final one.

Several other persons have directly contributed to the quality of this study. Robert M. Herskovitz and Clifford A. Pollack produced all of the excellent artifact photographs with the exception of Figures 57, 84, 103, 104, 108, and 109, which were taken by Alison Habel. Figures 86-89 were taken by Helga Teiwes of the Arizona State Museum as part of an agriculture study conducted with William Harper Doelle. Figures 110-115 were prepared by Dr. Timothy P. Loomis. Permission from the Arizona State Museum to use these photographs, the Frontispiece, and Figure 3 is appreciated. Charles Sternberg drafted all maps and line drawings in his usual superior manner. The cover design represents the artistry of Karl J. Reinhart.

Alice Holmes and Ellen Horn allowed me to peruse the photographic collections of the Arizona State Museum, while Jan Bell and Michael Jacobs assisted in my examination of artifact collections from past Arizona State Museum projects in the Papagueria. John Clonts, Douglas Brown, Jane Rosenthal, and Marc Severson provided valuable information on projects conducted by the Western Archeological Center in the Papagueria. Bruce B. Huckell and Lynn S. Teague graciously spent several hours of their time discussing current projects of the Arizona State Museum. Julian D. Hayden related several important observations on Papaguerian archeology. Dr. Emil W. Haury, Bruce B. Huckell, and George Teague assisted in some aspects of the analysis of artifacts from Gu Achi. David E. Doyel and Yvonne L. Stewart reviewed and provided useful comments regarding the content and organization of this volume.

A sincere and lasting appreciation is extended to the colleagues who contributed the excellent reports appended to this volume, Robert E. Gasser, Charles H. Miksicek, Diane P. McLaughlin, Paul C. Johnson, Alan Ferg, Larry D. Arnold, Harold W. Krueger, and Dr. Timothy P. Loomis, whose analysis was prepared for publication by Paulette. Gasser, Ferg, and Johnson are singled out along with Dr. Emil W. Haury, Dr. David E. Doyel, Dr. David R. Wilcox, and William Harper Doelle for helping to stimulate and mold much of my current thinking about the Hohokam.

Finally, this volume is dedicated to my parents, Gerald and Hope Masse, who instilled in me a love for things past and present in the Papagueria, and to Doc, whose knowledge, skills, and standards are to be emulated but can never be surpassed.

W. Bruce Masse
July 1, 1979
Tucson, Arizona

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Then, in the west there was a Blue Gopher who came with plenty of brush which he placed layer above layer around the house, covering it as with thin clouds. Around the house were four gopher hills with which he covered it with earth in a thin, even layer, as snow covers the ground. Looking around the earth I selected one to take me up like a little boy and place me in the house. He placed a brand of fire down before me and a cigarette also. Lighting the cigarette he puffed smoke toward the east in a great white arch. The shadow of the arch crept across the earth beneath. A grassy carpet covers the earth. Scattering seed, he caused the corn with the large stalk, large leaf, full tassel, good ears to grow and ripen. Then he took it and stored it away. As the sun's rays extend to the plants, so our thoughts reached out to the time when we would enjoy the life-giving corn. With gladness we cooked and ate the corn and, free from hunger and want, were happy. Your worthy sons and daughters, knowing nothing of the starvation periods, have been happy. The old men and the old women will have their lives prolonged yet day after day by the possession of corn.

People must unite in desiring rain. If it rains their land shall be as a garden, and they will not be as poor as they have been.

[Opening of Pima Rain Ceremony, Russell 1908: 347-348]

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INTRODUCTION

In the spring of 1973, the Western Archeological Center, National Park Service, conducted extensive surveys in the Papago Indian Reservation because of improvements proposed for several roadways (Stacy 1974). Among the numerous archeological features encountered were two prehistoric Hohokam sites. One of these, Gu Achi (AZ Z:12:13 ASM), is a major pre-Classic period Hohokam settlement a few miles west of Santa Rosa on Papago Indian Road (PIR) 34; the other site, Pisinimo, is a pre-Classic period campsite found along PIR 21 north of the modern village of Pisinimo. Because of the significance of these two sites, the Bureau of Indian Affairs, Phoenix Area Office, Branch of Roads, requested a testing program.

Excavation began at Gu Achi on June 20, 1973, and continued through August 28, 1973. Pisinimo was tested between July 20 and August 13, 1973. John B. Clonts of the Western Archeological Center was the field supervisor, and Dana Isham served as his assistant. Isham supervised the field work during the first two weeks at Gu Achi and all work done at Pisinimo. A crew of three to seven Papago Indians served as the daily labor force.

The excavation at Gu Achi recovered more than a thousand chipped and ground stone specimens, hundreds of pieces of shell jewelry and manufacturing debris and some 22,000 sherds, of which more than 2400 were decorated. Of special importance was the discovery of a burned ramada structure around which several hearths, storage pits, and large ceramic storage vessels were clustered. A single low trash mound and a large earthen-banked reservoir were located in brief survey outside the 200-foot right-of-way. The work at Pisinimo was more limited; hearths and a cache of unworked marine shell were the primary features of interest. A combined total of less than 5000 sherds, shells, chipped and ground stone pieces was recovered during the course of excavation there.

Budgetary limitations and involvement with other projects on the Papago Indian Reservation prevented immediate analysis of the Gu Achi and Pisinimo material at the Western Archeological Center (see Rosenthal, Brown, Severson, and Clonts 1978: 2). In May 1977, John B. Clonts hired the author to analyze the data from Gu Achi and to write the final report of the project.

investigations. Subsequently, the author spent several days on different occasions intensively surveying the site of Gu Achi and its environs. During this survey 44 significant features and areas of artifact concentration were recorded (Loci A-RR). These include one definite and several possible trash mounds, an earthen-banked reservoir, eroding pit houses, isolated hearths, a possible canal, and many sizeable sherd and lithic scatters.

Analysis of these features and the recovered material culture indicates that Gu Achi was first occupied during the late Pioneer period (about A.D. 500) and was continuously occupied until the middle of the Sedentary period (A.D. 1050-1100). The majority of features date to the transition between the Colonial and Sedentary periods (A.D. 850-1000). In addition, several small agricultural processing camps dating to the Classic period Sells phase (A.D. 1200-1450) were scattered throughout the site. The total area encompassed by the pre-Classic Hohokam features is nearly 150,000 sq. m. If the area between these features is taken into account (a method commonly used for deriving site size), the site area exceeds 1,000,000 sq. m. By either standard, Gu Achi is the most extensive pre-Classic period Hohokam settlement known in the Papagueria.

The site of Pisinimo was not visited by the author, and only portions of the site collections have been analyzed, specifically, the shell (Ferg 1977b) and the faunal remains (Johnson 1977). However, the author has briefly examined the ceramic and lithic collections in order to understand the nature of the site better. A summary of these findings and those from the site of Sil Nakya, another site tested by the Western Archeological Center, is presented in Chapter 6.

This report emphasizes several major concerns. First is the physical description of Gu Achi, with concentration on both the excavation itself (Chapter 2) and on surface manifestations observed during the author's survey (Chapter 3). This is followed by a detailed analysis of the material collected from the site (Chapter 4). The data from these three chapters provide a base for discussing aspects of chronology, subsistence practices, and settlement patterns at Gu Achi (Chapter 5). All previous work in the Papagueria is critically reviewed in an attempt to provide a contemporary synthesis of the nature of Hohokam cultural development (Chapter 6). A significant facet of this chapter is that the classic "Desert Branch" vs. "River Branch" dichotomy of the Hohokam culture (Haury and others 1950) no longer accords with our present understanding of the archeological record in the Papagueria. Instead, it now appears that the subsistence economy and most aspects of material culture of the Papaguerian Hohokam differed little from those of Hohokam populations in the Gila River Valley. Also, it now seems likely that the Classic period Sells phase populations in the Papagueria are not the direct descendants of the pre-Classic period Hohokam. These points will be discussed in Chapter 6 and will then be highlighted as part of a chronologic scenario that is presented in the concluding chapter (Chapter 7).

Several colleagues have contributed specialized analyses that are included in this volume. Robert E. Gasser analyzed 29 flotation samples from Gu Achi; the results of his work appear in Appendix A. This important study substantially alters our previous beliefs concerning the nature of prehistoric subsistence in the Papagueria. An analysis of corn kernels from Gu Achi and a reanalysis of corn cobs from Ventana Cave (Haury and others 1950) were undertaken by Charles H. Miksicek and are presented as Appendix B. His detailed examination of these specimens provides interesting insights on possible stressful environmental conditions under which the corn was cultivated. Appendix C, by Diane P. McLaughlin, contains the analysis of seven pollen samples from Gu Achi and complements the findings of Gasser. Paul C. Johnson studied the faunal remains from the site, including worked bone. His work, Appendix D, treats the range of faunal species utilized at Gu Achi and the processes that affect bone preservation in open archeological sites. Apart from Haury's (1976) study at Snaketown, Appendix E by Alan Ferg is one of the most thorough treatments of a large Hohokam marine and freshwater shell assemblage to date. Appendix F contains two brief discussions of the radiocarbon dates from Gu Achi by Larry Arnold and Harold W. Krueger, respectively. The final contribution to this volume, Appendix G, is a petrographic study of selected ceramics at Gu Achi by Dr. Timothy P. Loomis. The results of his study indicate that petrographic analysis can become a useful tool in Hohokam archeology.

Together, these appendices and the main body of the report provide a holistic picture of Hohokam subsistence and settlement in the Arizona Papagueria as it is known in 1979.

Chapter 1

THE PHYSICAL AND CULTURAL SETTING OF THE PAPAGUERIA

Physical Setting

"Papagueria" was the name employed by 17th and 18th century European missionaries and explorers to refer to that portion of the Southwest inhabited by the Papago Indians (Bryan 1925b: 1; Hackenberg 1964: II-1). This area of more than 20,000 square miles is bounded by the Santa Cruz River on the east, the Gila Valley on the north, the Colorado River on the west, and extended as far south as Caborca in Sonora, Mexico. In this report, the term "Papagueria" will refer primarily to the area north of the International Border that is bounded by the Baboquivari Mountains to the east, the Growler Valley to the west, and the Gila Valley to the north.

A hot, rugged, and desolate land, the Papagueria presents a most inhospitable appearance to the untrained eye. These aspects of the Papagueria have been popularized by the accounts of emigrants in the 1840's and 1850's who used the "Camino del Diablo" (Devil's Highway) to reach California. The Camino del Diablo, the southernmost of the emigrant trails, followed, more or less, the present-day International Border through the Papagueria and was claimed to have been responsible for the deaths of 300 to 400 pioneers. In fact, the Camino del Diablo was described as ". . . the most terrible desert trail to be found in all the southwestern arid region" (see Hornaday 1908: 113). This feeling toward the Papagueria pervaded even archaeological thinking, for many students have believed this area incapable of supporting the original populations above the level of bare necessities and simple nutrition.

As part of the Basin and Range Physiological Province of Arizona (Wilson 1962: 90-96), the Papagueria is characterized by a number of rugged northerly-trending mountain masses that rise abruptly above broad, plain-like valleys. In general, the relief of these mountain masses is low.

Peaks rarely rise more than 2000 feet above the adjacent valley floors. In the central portion of the Papagueria most valley floors are approximately 1800-2500 feet above mean sea level while the mountain peaks seldom exceed 4500 feet in elevation. The Baboquivari Mountains at the eastern boundary of the Papagueria, however, rise to a height of 7730 feet, nearly 5000 feet above the surrounding valley floors.

The geologic and physiologic history responsible for the present basin and range topography of the Papagueria is quite complex (Bryan 1925b: 114-118). The oldest deposits, formed in early pre-Cambrian times (prior to 620 million years ago) are sedimentary in origin. Later in the pre-Cambrian, masses of molten volcanic material transformed the sedimentary formations into schist while the molten material itself became granitic. Paleozoic and early Mesozoic (about 620 million to 70 million years ago) processes have been obscured by later erosion, but it appears likely that southern Arizona was under the sea during much of the Paleozoic and was subject to considerable volcanism during the Mesozoic. The formation of the mountain masses in the Papagueria took place in the Tertiary Period (70 million to 2 million years ago) during several episodes of uplift and faulting.

Volcanism was intensive and extensive during the latter portions of the Tertiary Period and during the Pleistocene (2 million to 10,000 years ago). The extent of this volcanic activity can be seen in lava fields such as the Pinacate region of Sonora, which covers a continuous area of nearly 600 square miles (Jahns 1959: 165), and in accumulations of lava that reached thicknesses of more than 2000 feet (Bryan 1925b: 116). Erosion of these Tertiary and Pleistocene age mountains and the deposition of alluvial material on the valley floors have created the present appearance of the Papagueria. These geological events provided the prehistoric populations with a wide range of raw materials to satisfy their lithic tool needs. The broad alluvial valleys also provided a substrate capable of supporting agriculture wherever water was available.

The Papagueria is in the Sonoran Desert, the richest of the four American deserts in diversity of plant communities and in number and variety of life forms (Shreve 1951: 25). (The other deserts are the Chichuahuan Desert, the Great Basin, and the Mojave Desert.) All but the westernmost portion of the Papagueria is included in the Arizona Upland vegetational subdivision of the Sonoran Desert. The Arizona Upland is dominated by two major biotic communities--the paloverde-saguaro (*Cercidium*-*Cereus*), which occupies rocky hill slopes and bajadas, and the creosote-bursage (*Larrea*-*Franseria*), which is found principally in the alluvial valley floors and on less steep bajada tops (Lowe 1964: 24-27). Large numbers of mesquite (*Prosopis*), ironwood (*Olneya*), acacia (*Acacia*), and other important riparian species grow in the numerous washes of the Sonoran Desert.

The faunal population of the Papagueria is also rich and varied, as would be expected from the diverse floral communities (Cockrum 1960; Lowe 1964; Hackenberg 1964). Among the larger mammals are bighorn sheep (*Ovis canadensis*), mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), and pronghorn antelope (*Antilocapra americana*). Smaller mammals include the coyote (*Canis latrans*), jackrabbit (*Lepus* sp.), cottontail rabbit (*Sylvilagus* sp.), badger (*Taxidea taxus*), pocket gopher (*Thomomys bottae*), and several species of squirrels, rats, and mice. Important reptiles include desert tortoise (*Gopherus agassizi*), mud turtle (*Kinosternon* sp.), and a variety of snake and lizard species. Birds such as Gambel's quail (*Lophortyx gambelii*) and mourning dove (*Zenaidura macroura*) are found throughout the Papagueria, and several species of birds of prey and even waterfowl are commonly observed.

In spite of the richness of the biota and the lithic resources of the Papagueria, there is no question that the presence or absence of water was a critical limiting factor to both the prehistoric ceramic-producing populations (circa A.D. 500-1450) and the historic Papago. There are few permanent natural springs in the Papagueria and no permanent streams like those that formerly existed in surrounding areas--the Gila Valley to the north, the Santa Cruz Valley to the east, and the Altar Valley to the south. Although the latter regions now receive only intermittent water flow, ample documentary evidence demonstrates that before this century, the major rivers in southern Arizona were permanent (see Hastings 1959; Hastings and Turner 1965; Doelle 1976; Wyllys 1931: 118).

The Papagueria, on the other hand, appears to have been without permanent, surface, water-bearing streams at least as early as the late [illegible]

	Elevation in Feet (meters)	Precipitation in Inches				Number of Days with Precipitation more than .10 inch		Mean Number of Freeze-Free (Growing Season) Days*	Temperature (Farenheit) Mean Daily Maximum		Mean Daily Minimum	
		Annual Mean	July-Sept Mean	Record Annual High	Record Annual Low	Annual Mean	July-Sept Mean		Jan	July	Jan	July
AJO	1763 (537)	8.95	4.57	15.27	3.46	25	11	336	64.1	103.2	40.9	78.4
GILA BEND	735 (224)	5.76	2.34	13.58	2.02	15	6		67.8	109.1	37.5	77.1
ORGAN PIPE CACTUS NAT MONUMENT	1678 (511)	9.17	4.38	14.86	3.38	26	11		67.0	102.7	37.3	73.4
PHOENIX	1117 (340)	6.74	2.47	12.57	2.82	23	8		64.6	104.4	38.0	78.3
PISINIMO	1900 (579)	8.72	4.68	14.06	3.91	26	12		65.3	103.6	38.3	72.9
SANTA ROSA SCHOOL	1840 (561)	10.06	5.55	13.56	7.86	20	10		64.8	104.9	33.6	72.2
SELLS	2405 (733)	12.02	6.46	18.99	6.76	32	15	266	65.1	101.2	36.0	71.5
TUCSON	2444 (745)	10.73	5.30	16.26	5.72	34	14	265	66.0	101.1	36.7	73.3
YUMA	120 (37)	2.57	0.73	6.05	0.43	11	3	280	68.4	106.6	36.8	73.6

*data from Hackenberg (1964: II-5)

Table 1. Climatic data from selected locations in southern Arizona (after Sellers and Hill 1974)

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(Pfefferkorn 1949: 37; Bolton 1936: 281-282, 397) and, as current archaeological and geological evidence indicates, probably not for thousands of years prior to European contact. Surprisingly, the annual precipitation levels throughout most of the Papagueria approximate those of adjacent regions. East of Ajo towards Sells, yearly precipitation gradually increases from approximately 9 inches to 12 inches, more than half of which falls in July, August, and September (Sellers and Hill 1974). This is comparable to the 10 inches that Tucson averages per year and is substantially greater than the 7.5 inches received by Phoenix. West of Ajo, the yearly precipitation level drops sharply to a low of 3 inches near Yuma and Dateland. Table 1 presents climatic data from selected locations in southern Arizona.

The absence of permanent streams in the Papagueria can be attributed to the fact that the area contains a series of small watersheds. Nearly all the water comes from precipitation within each watershed alone and not from areas outside of the Papagueria. Streams that were permanent in historic times, such as the Gila and its major tributaries, have their origins outside of southern Arizona at higher elevations (above 4000 ft.) that receive greater amounts of precipitation over a wider area than streams in the Papagueria. If for some reason the Gila River and its tributaries were to be eliminated from Arizona, the environment of the Gila, Salt, and Santa Cruz River Valleys would probably differ little from that of the Papagueria.

Cultural Setting

The earliest evidence, to date, for human occupation in the Papagueria comes from the lower levels of Ventana Cave, a large rockshelter not far from Gu Achi (Haury and others 1950). Radiocarbon samples, dating roughly between 9350-10,650 B.C. (Haury and Hayden 1975: v-vi), were recovered in association with projectile points, scrapers, marine shell, and other material culture items diagnostic of an early hunting/gathering population. The Ventana Cave remains are part of a widespread Paleo-Indian tradition reported from other contemporaneous sites in southern Arizona such as the Clovis culture population at the Lehner Mammoth Site in the upper San Pedro Valley (see Haury, Sayles, and Wasley 1959). Haury used the term "San Dieguito" to indicate that the Ventana Cave materials were closely affiliated to specimens recovered earlier from the deserts around the lower Colorado River. The San Dieguito culture populations appear to have emphasized gathering to a greater extent that did the big-game hunting Clovis culture groups.

On the basis of his work in the Sierra Pinacate on the western border of the Papagueria, Hayden (1976) has recently defined an earlier tool tradition. This tradition, the "Malpais stage" of the San Dieguito complex, may date to 40,000 B.C. or earlier according to Hayden. The Malpais stage consists of chipped stone tools, heavily coated with desert varnish, that are found in association with areas of "desert pavement" (consolidated patches of gravels and small cobbles coated with desert varnish). Unfortunately, Malpais stage artifacts are known only from surface contexts, and their dating is based solely on somewhat speculative geologic dating.

The evidence from Ventana Cave and other sites (see Rosenthal and others 1978) indicates that Archaic period hunters and gatherers actively occupied portions of the Papagueria. This occupation took place from 8000 B.C. to possibly as late as A.D. 300-500. The stratigraphy of Ventana Cave exhibited an unexplained hiatus in occupation between approximately 9000-4000 B.C., but data from southeastern Arizona (Sayles and Antevs 1941) seem to indicate that Archaic peoples were in the Papagueria at this time.

It is uncertain when the Archaic populations disappear from the archeological record in the Papagueria; no late Archaic sites in the Papagueria, indeed few in all of southern Arizona, have been radiometrically dated. Haury places the ending of the Archaic period in the Papagueria around A.D. 1 (Haury and others 1950), while Rosenthal (Rosenthal and others 1978) feels that Archaic occupation may have lasted until A.D. 800. However, as discussed in this report, a substantial movement of ceramic-producing Hohokam into the Papagueria occurred around A.D. 500, which is the date that will be tentatively offered here as the end of the Archaic period. The nature of the interaction between the late Archaic populations and the initial Hohokam immigrants is not known and remains an important problem for future research.

The Hohokam were a group of sedentary agriculturalists whose earliest known appearance has been archeologically documented at Snaketown in the

Gila River Valley (Gladwin and others 1937; Haury 1976). Haury (1976) dates the beginning of the Hohokam culture around 300 B.C. and feels that the Hohokam immigrated to the Gila River Valley from some unknown place in Mexico. He suggests that these Mexican emigrants brought with them a knowledge of pottery making, stone sculpting, shell carving, a figurine complex, and canal irrigation technology for cultivating crops such as corn, kidney beans, and squash.

Haury (1976: Table 16.1) has devised a chronology for the Hohokam, based in large part on a seriation of the decorated ceramics found at Snaketown. A slightly modified version of his chronology and associated pottery types is given in Table 2. Recently, both his chronology and his hypothesis on the origins of the Hohokam culture have been questioned. Wilcox and Shenk (1977: 174-182) have suggested that the Hohokam derived from local indigenous Archaic populations of southern Arizona (a proposition entertained by Haury [Haury and others 1950: 355, 535-536] earlier in his career) about A.D. 100. Plog (in press) has also questioned Haury's chronology and has suggested that several of the decorated pottery types (for example, Sacaton Red-on-buff and Santa Cruz Red-on-buff) are in fact contemporaneous. He proposes that several of Haury's phases be collapsed and that the dating of these phases be drastically revised.

These issues cannot be completely resolved at the present time, but evidence to date seems to support Haury's chronology for the late Snaketown through Civano phases (about A.D. 500-1450). The early portion of the chronology seems to be more open to revision, and increasing evidence appears to support an initial date for the Hohokam between A.D. 1-300 (Masse n.d. b). However, in this volume, we will utilize the chronology developed by Haury, keeping in mind that future revisions may be necessary.

Sometime late in the Snaketown phase (about A.D. 500), the Hohokam moved into the Papagueria from the Gila River Valley. This was part of a widespread expansion by the Hohokam into the regions surrounding the Hohokam "core area" of the Gila and Salt River Valleys (Masse in press a, n.d. b). In the Papagueria this "colonization" is marked by substantial occupations at Gu Achi and at AZ AA:5:30, a major settlement along Santa Rosa Wash about 15 miles north of Gu Achi. Ceramics dating to the Sweetwater and Estrella

DATE	PERIOD NAME	PHASE NAME	ASSOCIATED POTTERY TYPES*
A.D. 1600	Protohistoric		
1500			
1400	Classic	Civano	Casa Grande Red-on-buff, Salt Red, Gila Red, Gila Plain, Tanque Verde Red-on-brown*
1300			
1200		Soho	Casa Grande Red-on-buff, Gila Red, Gila Plain, Tanque Verde Red-on-brown*
1100			
1000	Sedentary	Sacaton	Sacaton Red-on-buff, Sacaton Red, Gila Plain, Rincon Red-on-brown*, Rincon Red*
900			
800	Colonial	Santa Cruz	Santa Cruz Red-on-buff, Gila Plain Rillito Red-on-brown*
700			
600		Gila Butte	Gila Butte Red-on-buff, Gila Plain, Canada del Oro Red-on-brown*
500	Pioneer		
400		Snaketown	Snaketown Red-on-buff, Vahki Red Gila Plain
300		Sweetwater	Sweetwater Red-on-gray, Vahki Red Gila Plain
200			
100		Estrella	Estrella Red-on-gray, Vahki Red, Gila Plain
1			
B.C. 100		Vahki	Vahki Red, Vahki Plain
300			
500	Archaic		

*Pottery types denoted with an asterisk are from the Tucson Basin Series.

Table 2. Hohokam chronology and associated pottery types. (Dating follows Haury 1976: Table 16.1).

phases were recovered in small numbers from Ventana Cave but cannot be used to indicate anything more than intermittent Hohokam use of the Papagueria before A.D. 500.

Between A.D. 500-1100 (late Snaketown through Sacaton phases) the Hohokam occupied most of the Papagueria. The period of approximately A.D. [illegible]-1000 (late Santa Cruz/Sacaton phase) was a time of especially intense occupation. Several substantial agricultural communities scattered along the Santa Rosa Wash and its tributaries and in other parts of the Papagueria date to this period. Some villages, such as Gu Achi, contained large man-made reservoirs, ostensibly to provide a reliable domestic water supply. In addition there is archeological evidence in these Papaguerian villages of successful floodwater farming and considerable involvement in Hohokam Southwestern shell trade. The intensity of Hohokam cultural development in the Papagueria during this period is part of a widespread phenomenon occurring throughout southern Arizona (Masse in press a; Doyel in press).

Around A.D. 1100 the complexion of Papaguerian prehistory changed dramatically. There seems to have been little, if any, continuity between the pre-Classic period and Classic period populations. Substantial changes in architecture, ceramics, use of marine shell, subsistence, and settlement patterns occurred over a seemingly short span of time. By A.D. 1200 (or shortly before) "Sells" phase populations had spread throughout most of the Papagueria. This cultural group is related directly to Classic period populations in the Tucson Basin, and both may be more directly related to pre-Classic Mogollon and Sonoran groups than to the Hohokam (Masse in press a).

The present discussion is at variance with the traditional model of Papaguerian Hohokam cultural developments formulated by Haury (Haury and others 1950: 546-548). Haury's model envisioned a movement of Hohokam into the Papagueria from the Gila River Valley. Because of the arid conditions of the Papagueria, especially the lack of permanent streams for canal irrigation, he considered the Papaguerian populations to be a specialized "Desert Branch" of the Hohokam culture in opposition to the "River Branch" of the Gila and Santa Cruz River Valleys. Haury's model will be examined more thoroughly in Chapters 5, 6, and 7 of this volume.

Until A.D. 1450, the Sells phase populations occupied the Papagueria in considerable numbers, living in Pueblo-like villages. Around A.D. 1450 a major drought in the Southwest (Euler and others in press) apparently created serious cultural upheavals. At this time several cultural entities in central and southern Arizona disappear from the archeological record, including the Salado Culture, the Hohokam culture, and the Tucson and Sells phase populations from the Tucson Basin and Papagueria, respectively. Factors other than drought may have contributed to this disappearance, but for the present these are unknown or poorly understood.

The period between A.D. 1450-1700 in southern Arizona is commonly referred to as the "protohistoric" because we do not have much reliable historical documentation of this region before the arrival of the Jesuit priest, Father Eusebio Francisco Kino, and his frequent military escort, Juan Mateo Manje, at the end of the 17th century (see Bolton 1948). By this time Piman-speaking groups occupied most of southern Arizona. These included the Sobaipuri in the San Pedro and Santa Cruz Valleys, (see DiPeso 1953) the lower Pimans ("Sonorans") of the Sonora (Pfefferkorn 1949), the Pimans of the Gila River Valley, the Sand Papago (Arenenos) of the western Papagueria (Hayden 1967), and the Papago of the central and eastern Papagueria. Even though these Piman speakers were found by Manje and Kino in nearly the same locations occupied by earlier prehistoric Hohokam populations, the link between the Pimans and the Hohokam is by no means clear. Haury expressed strong support for a direct continuum between these two groups (Haury and others 1950: 542-543; Haury 1976: 357). Others (for example, Fontana 1976; Fritz 1977) have stated that there was a general abandonment of southern Arizona around A.D. 1450, and the vacuum was filled one or two centuries later by Pimans moving in from the south. There is presently not enough evidence to support either position convincingly, and it is possible that each position is partly correct. The Hohokam probably did not abandon southern Arizona but, because of drought and other factors, were rapidly absorbed by Piman groups who moved into southern Arizona as Hohokam society fragmented (Masse 1979).

At the time of missionization, the inhabitants of the Papagueria, the Papago, appear to have practiced a yearly bilocational residence pattern

(Castetter and Underhill 1935). Thus, they spent the summer in "field" villages, where crops were planted and harvested, rabbits were hunted, and reservoirs were dug to provide a domestic water supply. When the reservoir dried up in the fall, the Papago moved to their "well" villages, located at reliable water sources near the mountains. During the winter the Papago hunted deer and crafted their pottery and baskets.

A wealth of historic documentation and ethnographic data pertains to the customs, subsistence practices, and settlement patterns of the Papago and the Gila River Pima. Several excellent and informative archeological monographs have used this data to provide models of prehistoric behavioral patterns in southern Arizona (see, for example, Haury and others 1950; Haury 1976; DiPeso 1956; Goodyear 1975; Doelle 1976, 1978). The present volume also uses this data on the Piman groups to understand better the nature of pre-Classic period Hohokam and Sells phase settlement and subsistence in the Papagueria. Use of ethnographic analogy, however, does not imply a direct link between the Hohokam and later Piman groups.

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Chapter 2

EXCAVATIONS AT GU ACHI

Background

The site of Gu Achi was located in March 1972 during a survey of the right-of-way for the proposed widening and paving of PIR 34 between Santa Rosa and Ventana Junction (Stacy 1973). During the survey and excavation it was not known that Frank Midvale had previously recorded the site for Gila Pueblo in 1929 because the Arizona State Museum had not yet integrated the Gila Pueblo site survey information into its system (see Chapter [illegible]). For the National Park Service survey Gu Achi was described as a sherd and lithic scatter almost a mile in length. A subsequent road grader that in April uncovered several in situ hearths. Because of the limitations of right-of-way survey, the extent and nature of Gu Achi unfortunately were not realized. The highway right-of-way generally contained only Santa Cruz/Sacaton phase deposits, and it was thus mistakenly concluded that Gu Achi represented a single component Hohokam village site of the Sacaton phase. The reservoir, trash mound, and extensive late Pioneer period occupation areas went unnoticed because they could not be observed from the right-of-way.

On the basis of the survey data the National Park Service initiated an in-house research project to excavate within the right-of-way at Gu Achi. Six weeks of fieldwork were scheduled by two supervisory archeologists (John B. Clonts and Dana Isham) and a labor force of seven Papagos. The fieldwork began on June 20, 1973, and continued through the hottest part of the summer. By the middle of July it was realized that Gu Achi contained a far greater concentration of material than had been previously believed. In situ features and extensive occupational surfaces were encountered at depths greater than a meter below ground surface.

Several working days were lost because the summer monsoons, transportation problems, and the breakdown of vehicles hampered excavation activities. Furthermore, most of the first five weeks of field photographs were lost because of a camera malfunction. In addition, the Bureau of Indian Affairs had begun construction on PIR 34, and by the end of July Gu Achi had become an island surrounded by road construction activities. The Bureau of Indian Affairs wanted to begin construction at Gu Achi as soon as the six-week contract period expired. Fortunately, the Bureau of Indian Affairs graciously permitted the excavations to continue until the end of August, but throughout much of the month of August the field crew had to be used at both Gu Achi and the distant site of Tlainimo.

Because of these logistic problems, the excavation of Gu Achi was hurried and not as comprehensive as it might have been under more favorable conditions. The recording of field observations was sometimes sketchy, and in a few instances provenience and associational data were lost. Nevertheless, the richness of information gathered at Gu Achi cannot be overemphasized. The excavations at Gu Achi have, at the very least, laid a solid foundation for renewed interest and a major change in our perspective of Hohokam archeology in the Papagueria.

Physical Setting of Gu Achi

Gu Achi lies in the eastern portion of Window Valley approximately 11 km due east of Window Mountain and the natural arch (or "ventana") for which the valley is named. The term "Gu Achi" was borrowed from the wash that borders the site and from the village of Santa Rosa, which in past years had been called Gu Achi. "Gu Achi," a Papago term literally translated as "big (Gu) narrow ridge (Achi)" (Barnes 1960) or more commonly "Big Peak" (Barnes 1935), probably refers to the large peak at the southern end of the Santa Rosa Mountains, east of Santa Rosa Village. Papago crew members, however, translated "Achi" as "wash."

Gu Achi is near the center of the valley floor in a creosote plain that rises a meter or two above the floodplains of the surrounding washes. Two major washes, running roughly parallel, drain this portion of the Window Valley into the Santa Rosa Wash to the east (see Fig. 1). The larger, Gu Achi Wash, borders Gu Achi on the south. Gu Achi wash is broad, [illegible] 25-35 m in width, and has become entrenched more than 1 m below its floodplain. Most probably this entrenchment is related to the [illegible] cycle of arroyo-cutting that began in the late 1880's (Bryan 1925; Antevs 1952; Hastings 1959; Hastings and Turner 1965; Cooke and Reeves 1976). The distribution of prehistoric artifacts and features along Gu Achi Wash suggests that the present channel is in approximately the same place as it was during the Hohokam occupancy of the valley.

The upper 1-2 m of the banks of Gu Achi Wash are fine-bedded silts and sands while the bottom meter is a jumbled mass of large cobble- and boulder-sized angular rocks with rounded corners. Apparently the earlier regime of the wash consisted of violent, fast-moving water that cut through and transported pre-Pleistocene materials for short distances. This was followed by a period in which slower-moving water deposited the silts and sands. The evidence from the 1973 excavation and from a brief examination of the banks of arroyos that have cut through the site suggests that the prehistoric occupancy of Gu Achi took place in the middle of the latter depositional cycle.

In most places there is at least one meter of silty alluvial fill between the boulder deposits and the bottom of the occupation layer. Likewise, there is from .35 m to more than .75 m of silt above the level of occupation in areas not denuded by recent erosion. This deposition of silts most likely occurred in the form of sheetwash from the surrounding bajadas, though a small percentage may be aeolian in origin. The deposition by sheetwash was, no doubt, largely responsible for the intensity of prehistoric occupation by the Hohokam and later Sells phase populations as it provided a rich environment for floodwater farming.

Anegam Wash is the other major drainage that flows through this portion of Window Valley. It is considerably smaller than Gu Achi Wash, averaging only 10-12 m in width, but exhibits the same degree of channel entrenchment and a similar depositional history. Figure 3 illustrates the steepness of its banks and the rocky cobble and boulder substratum into which the channel has cut. Although Gu Achi Wash and Anegam Wash are parallel and less than 1.5 km apart at the site of Gu Achi, the prehistoric populations favored

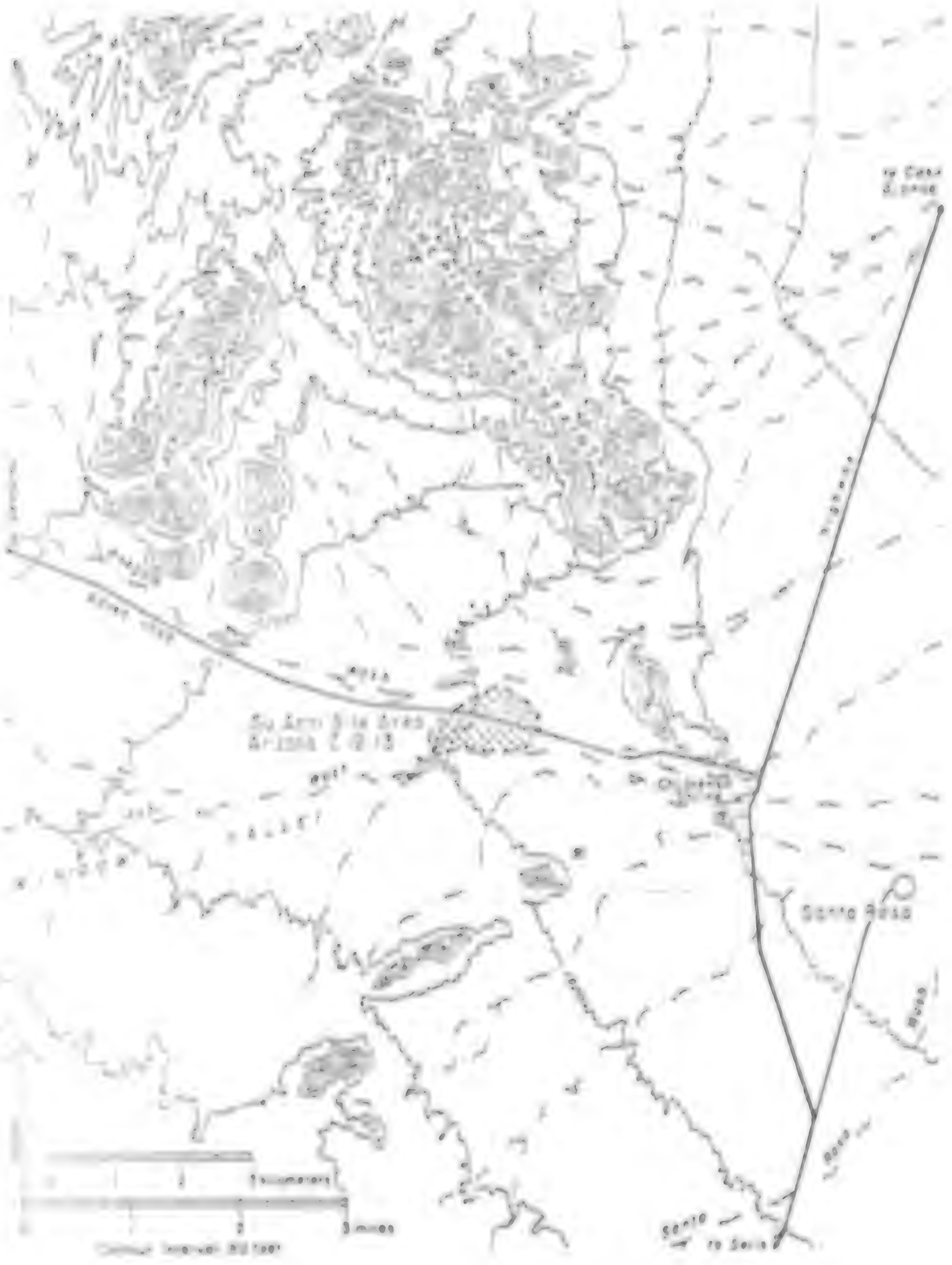


Figure 1. Map of Gu Achi and surrounding area.

settlement near Gu Achi Wash rather than near [illegible] Wash. Gu Achi Wash probably provided a more dependable supply of domestic water (through the possible use of wells and of canals leading to the reservoir) and a better source for tapping floodwater for farming than did [illegible] Wash.

The hydrology of this portion of the Papagueria has not received systematic study. Review of Bryan's study of the water resources in the Papagueria (1925b), evidence presented on a U.S.G.S. topographic map (Gu Achi, Arizona, 15' quad, 1963), and the author's on-foot examination of the area surrounding Gu Achi indicate that permanent water sources such as springs were not available in the vicinity of Gu Achi, with the exception of Ventana Cave, more than 15 km to the west (Haury and others 1950). Thus, the population at Gu Achi most likely depended initially on water obtained from shallow wells dug in the bottom of Gu Achi Wash ([illegible] 1981: 11-8), and during the later stages of site occupation, on water trapped in the reservoir. Pumpelly presents an interesting picture of Papago water-gathering activities that, though somewhat romanticized, bears repeating here (1918: I, 220-221):

> Most of the Papago villages on the desert were several miles from any water, and one of the chief occupations of the women was the obtaining of it, and bringing it home. I say obtaining; for getting water there was often a labor of patience, skill, and danger. In many places it was to be had only by digging. A spot was chosen where the rock dips under a deposit of sand, and an opening like a quarry was sunk in the latter, exposing the rocky surface. The little water that trickles slowly, drop by drop, along the plane of contact between sand and stone, was collected with the greatest care till [sic.] the labor was rewarded by a few quarts in the earthen vessel which the woman then bore off on her head, perhaps six or nine miles. In very dry seasons water could be had only by extensive digging of this kind. A friend once reached one of these wells at a time when, after a succession of dry seasons, the Indians were dying from thirst. He found a large number of natives digging feverishly far below the surface, and following down the line of contact between sand and rock, in the vain hope of finding a few drops of water. In their despair they undermined the high face of the sand and it fell, burying forever a number of the unfortunate women.

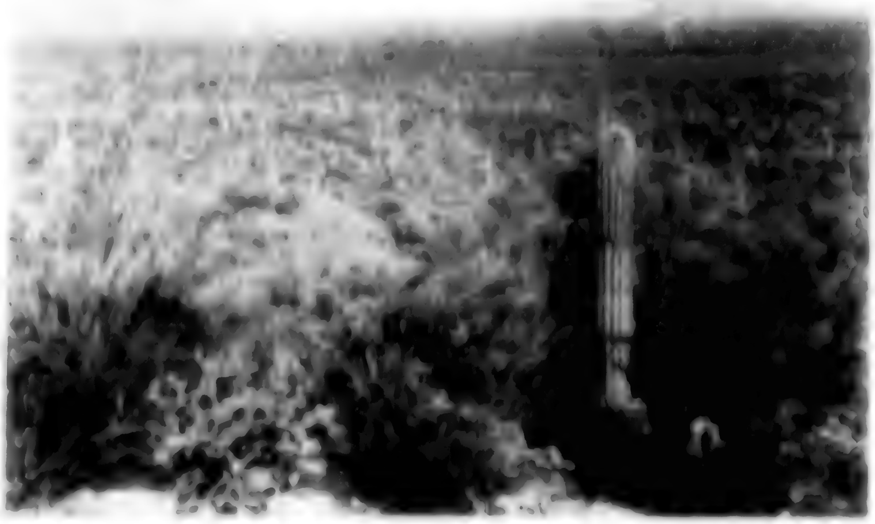


Fig. 2. View looking east from the Black Hills toward Santa Rosa Valley. Note the large numbers of saguaros on the bajada tops.

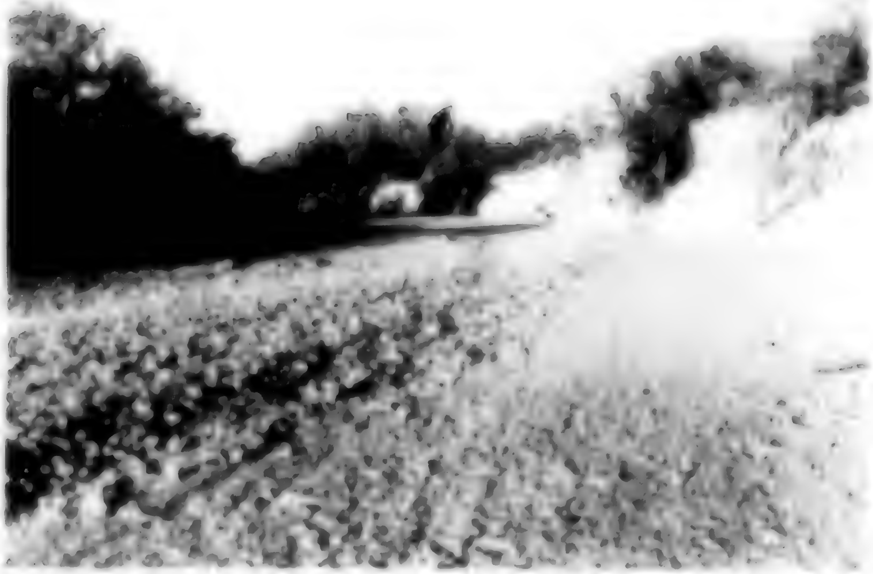


Fig. 3. Anegam Wash, looking east. Note the steep banks resulting from the entrenchment of the wash.

Whether the Hohokam of Gu Achi obtained water in the same manner will probably never be known. Most of the time, however, perhaps even in the dry winter and spring months, water could probably be obtained from shallow wells dug into the bed of Gu Achi Wash. A relatively thick layer (0.25-1.0 m) of caliche caps the boulder/gravel deposits in several locations along the banks of the wash. Such a feature would have effectively prevented ground water from percolating too rapidly through the coarse alluvium. Possibly, during exceptionally dry years, periodic trips may have been taken to Ventana Cave for water. Such trips might help to explain the presence of pre-Classic period Hohokam materials in Ventana Cave (Haury and others 1950).

The vegetation within the site boundaries at Gu Achi is almost solely creosote (*Larrea divaricata*), except in those places suitable for riparian species. Comparison of a photograph taken by Frank Midvale in 1929 (Fig. 4) and a modern photograph of the site (Fig. 5) shows the stability of the creosote community. The only noticeable difference is that the individual creosote plants appear somewhat larger in the 1929 photograph than they do at present.

Both Gu Achi Wash and Anegam Wash contain a rich assortment of riparian species, dominated by the economically and nutritionally important mesquite (*Prosopis juliflora*). Other species along the washes include catclaw (*Acacia greggii*), blue paloverde (*Cercidium floridum*), whitethorn acacia (*Acacia constricta*), bursage (*Franseria deltoidea*), crucifixion thorn (*Holacantha emoryi*), desert broom (*Baccharis sarothroides*), desert honeysuckle (*Anisacanthus thurberi*), saguaro (*Cereus giganteus*), and several species of cylindropuntia, such as staghorn cholla (*Opuntia versicolor*) and Christmas cholla (*O. leptocaulis*).

Immediately south of Gu Achi Wash a series of low, flat, north-trending bajadas extends from the Brownell Mountains. These bajadas contain greater numbers of cobbles and gravels than the Gu Achi site area and appear to be more stable than the substrate of the site area because exposed cobbles display a thin coat of desert varnish (patination). There are substantially greater numbers of saguaros and bursage on the bajadas than around Gu Achi. The teddy-bear cholla (*Opuntia bigelovii*), foothills paloverde (*Cercidium microphyllum*), and hedgehog cactus (*Echinocereus* sp.) are also present.

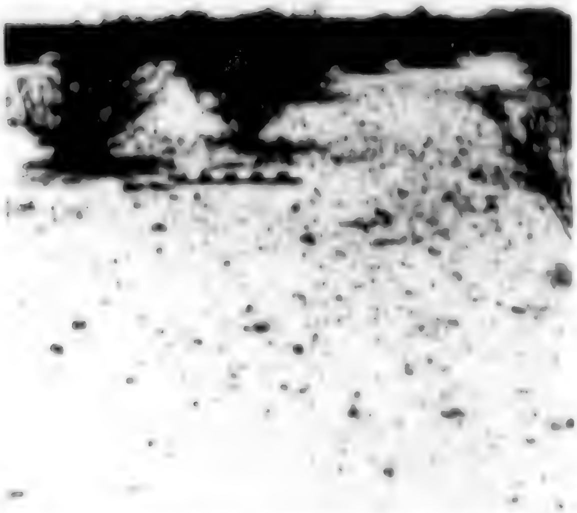


Fig. 4. General view of Gu Achi with the moderately heavy cultural concentration of Locus E in the foreground, looking west.

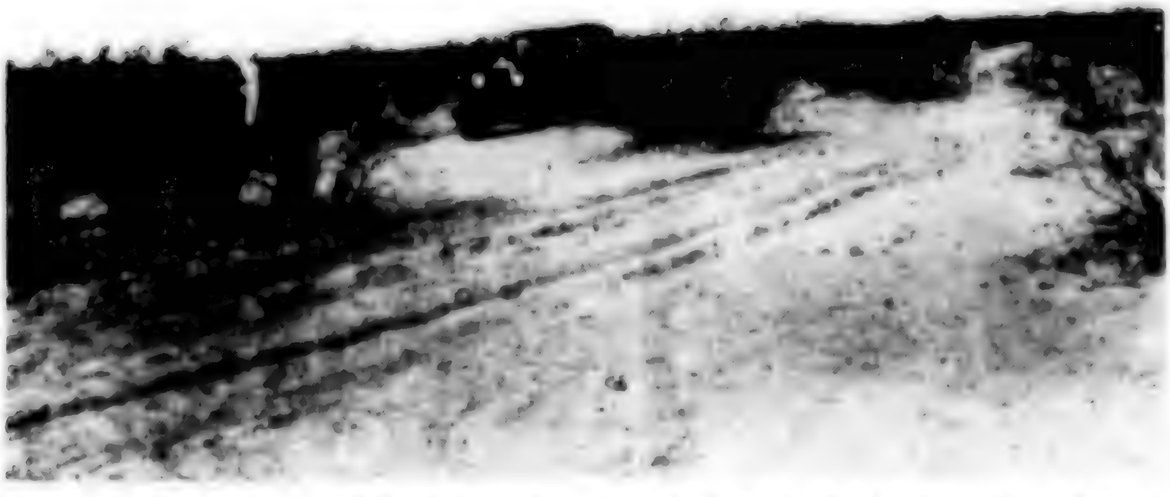


Fig. 5. Photograph of Gu Achi taken by Frank Midvale in November 1929. Same general view as above. Note the similarity in vegetation between the two photographs. (Courtesy of the Arizona State Museum, Gila Pueblo photograph.)

North of Anegam Wash and less than 1 km northeast of Gu Achi is a small isolated hill of schistose material. Around and on this hill are large numbers of saguaro and ocotillo (*Fouquieria splendens*), along with ironwood (*Olneya tesota*), foothills paloverde, bursage, creosote, buckhorn cholla (*Opuntia acanthocarpa*), hedgehog cactus, brittlebush (*Encelia farinosa*), and wolfberry (*Lycium berlandieri*).

A series of photographs taken from the top of this hill helps to illustrate the nature of the terrain and vegetative cover around Gu Achi. Figure 6 looks south toward the Brownell Mountains. In the foreground the foot of the hill has a cover of saguaro and ocotillo. Anegam Wash is delineated by the bare light-colored channel and surrounding dark-colored riparian plant community. South of Anegam Wash, the flat creosote plain where Gu Achi lies clearly displays its monotonous homogeneity. The dark line of vegetation in the distance marks the course of Gu Achi Wash. Figures 7 and 8 look, respectively, west toward the Black Hills and northwest toward the unnamed valley between the Black Hills and the Sheridan Mountains. Here numerous small drainages dissect the bajadas. These bajadas are dotted with saguaros, which form increasingly heavier stands closer to the foot of the mountain ranges. Sizeable numbers of staghorn and teddy-bear cholla, range ratney (*Krameria grayi*), creosote, bursage, ocotillo, and limberbush (*Jatropha cardiophylla*), along with the normal riparian species associated with small washes, also grow there. The slopes of the Sheridan Mountains were not visited, but the eastern slopes of the Black Hills contain many specimens of the following species: limberbush, foothills paloverde, saguaro, prickly pear cactus (*Opuntia* cf. *phaeacantha*), buckhorn cholla, ocotillo, brittlebush, barrel cactus (*Ferocactus* cf. *covillei*), and wolfberry. Figure 2 looks east from the Black Hills toward the Santa Rosa Valley. The dense stands of saguaro can be seen on the gently sloping bajada tops.

The faunal species noted during the fieldwork at Gu Achi included jackrabbits (*Lepus* sp.), cottontail rabbits (*Sylvilagus* sp.), and a variety of lizards, snakes, and birds. The more comprehensive list in Table 3 includes species encountered by Haury (Haury and others 1950: 151-152) in the "modern" (after 8000 B.C.) levels of Ventana Cave. Not all of these species were necessarily available to the Hohokam populations of Gu Achi. For

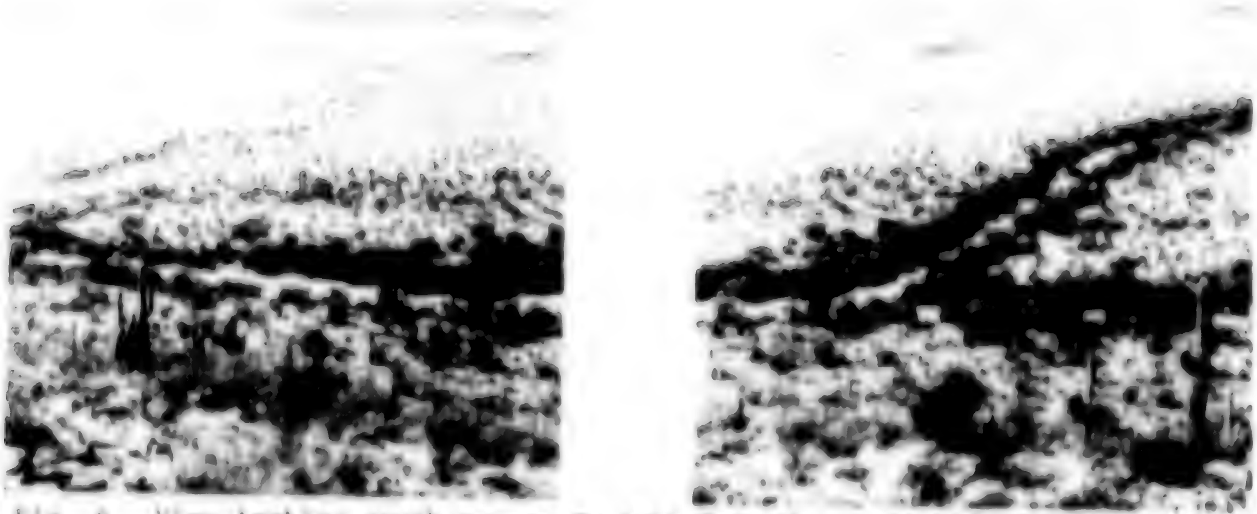


Fig. 6. View looking south across Gu Achi from the small hill immediately north of Anegam Wash. Anegam Wash lies in the foreground. Faint dark lines of vegetation and the lighter-colored area in the upper portion of the photographs represent Gu Achi.

Fig. 7. View looking west from same location as above. Southern tip of the Black Hills is in top center, with the Castle Mountains in the background.

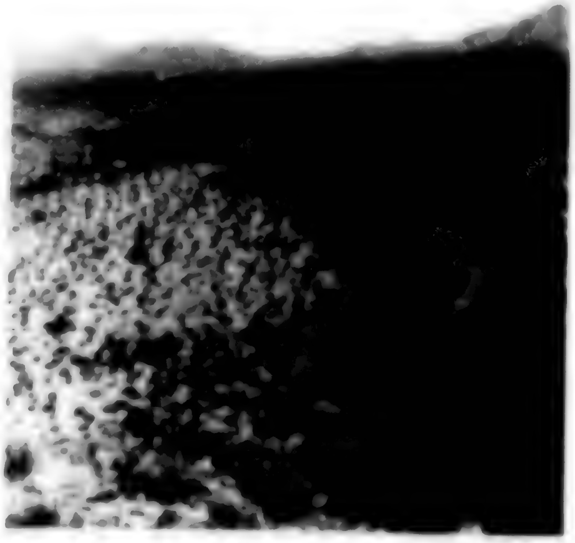


Fig. 8. View looking northwest from same location as above. The Black Hills are on the left and the Sheridan Mountains on the right.

example, species such as black bear and yellow-haired porcupine may have been present during portions of the Archaic period but not in later times. Likewise, the domestic horse, sheep or goat, and cow are all species introduced by Europeans during the historic period and thus were not available to the Hohokam.

The small mountain ranges that surround Gu Achi contain many useful deposits that could have satisfied the lithic needs of the prehistoric population. The southern tip of the Sheridan Mountains and the isolated hills between Gu Achi and Santa Rosa are composed almost entirely of schistose material. The crushed schist used as a temper in much of the locally made pottery and, most, if not all, of the tabular schist used for tools by the Gu Achi inhabitants came from these sources. Granite can also be obtained in the Sheridan Mountains, and sandstone, shale, limestone, and quartzite can be found in isolated outcrops. The Black Hills, as the name suggests, contain large amounts of andesite and basalt, along with some sandstone, shale, and conglomerate. On the eastern slopes of the Black Hills were many chunks of vesicular basalt that would have been perfectly suitable for making metates and manos and for use as hearthstones. The Brownell Mountains to the south hold large deposits of sandstone, shale, limestone, and quartzite. The green quartzite predominant among the chipped stone material types at Gu Achi most likely was procured from sources in the Brownell Mountains. Only a few lithic materials, such as obsidian, may not have been available near Gu Achi.

A final consideration of Gu Achi's environmental setting is that of climate. According to an eleven-year record (1959-1970), Santa Rosa receives an average of 10 inches of rainfall per year, more than half of which falls during the summer growing season (see Table 1). This type of rainfall pattern is advantageous for both dry farming and floodwater farming. When it is coupled with the dendritic small wash pattern and the broad alluvial flood plains of Window Valley and the Santa Rosa Wash drainage system in general, this pattern of rainfall permits floodwater agriculture. Hackenberg (1964: II-8, 9) remarks on the potential for agriculture created by the environmental condition in areas like Gu Achi as follows:

MAMMALS

Jackrabbit (*Lepus californicus eremicus*)
*Antelope Jackrabbit (*Lepus alleni*)
*Desert Mule Deer (*Odocoileus hemionus ? canus*)
Coyote (*Canis latrans*, subsp. ?)
*Berlandier's Badger (*Taxidea taxus berlandieri*)
*Audubon Cottontail (*Sylvilagus audubonii arizonae*)
Pronghorn Antelope (*Antilocapra americana*)
*Bighorn Sheep (*Ovis canadensis*, subsp.?)
Rock Squirrel (*Citellus variegatus grammurus*)
*Wildcat (*Lynx rufus baileyi*)
Gray Fox (*Urocyon cinereo-argenteus scotti*)
Yellow-haired Porcupine (*Erethizon epixanthum couesi*)
Kit Fox (*Vulpes macrotis arsipus*)
Sonora Deer (*Odocoileus couesi*)
Prairie Dog (*Cynomys ludovicianus arizonensis*)
Wood Rat (*Neotoma*, sp. ?)
Mountain Lion (*Felis concolor azteca*)
Wolf (*Canis lupus*, subsp. ?)
Skunk (*Mephitis*, sp. ?)
Spotted Skunk (*Spilogale arizonae*)
Black Bear (*Ursus americanus amblyceps*)
Cacomistle, also "Ringtail" (*Bassariscus astutus flavus*)
Chipmunk (*Eutamias*, sp. ?)
Pocket Gopher (*Thomomys*, sp. ?)
Pocket Mouse (*Perognathus*, sp. ?)
Kangaroo Rat (*Dipodomys*, sp. ?)

*species recovered from Gu Achi (see Appendix C).

DOMESTICATED MAMMALS

Dog (*Canis familiaris*)
Horse (*Equus caballus*)
Sheep or Goat (*Ovis aries*, or *Capra hircus*)
Cow (*Bos taurus*)

REPTILES

Berlandier's Tortoise (*Gopherus berlandieri*)
Gila Monster (*Heloderma maculatum*)
Horned Toad (*Phrynosoma*, sp.)
*Snakes and lizards (unidentified)

BIRDS

Red-tailed Hawk (*Buteo borealis*)
Horned Owl (*Bubo virginianus*)
Barn Owl (*Tyto alba*)
Turkey Vulture (*Cathartes aura*)
Raven (*Corvus corax*)
Roadrunner (*Geococcyx californianus*)
Marsh Hawk (*Circus hudsonius*)
Prairie Falcon (*Falco mexicanus*)
Gambel (?) Quail (*Lophortyx* (*gambeli* ?)
Scaled (?) Quail (*Callipepla* (*squamata* ?)
Mourning Dove (*Zenaidura macroura*)
White-winged Dove (*Melopelia asiatica*)
Brown Pelican (*Pelecanus occidentalis*)

Table 3. "Modern" (post-8000 B.C.) fauna found in Ventana Cave. (Dating follows Haury 1976: Table 16.1).

> From study of the distributions of rainfall and agriculture, it appears that a minimum of seven inches of rain is necessary for pursuit of the Papago pattern of flood water farming. This pattern relies upon two factors: (1) the presence of fertile alluvial soils on the outwash slopes which form aprons of topsoil and plant debris at the mouths of washes (known as akchin to the Papagos), and (2) the action of the network of water-courses to concentrate sufficient rainfall on the outwash slopes to irrigate a crop. In the absence of seven inches of rainfall, aggradation is insufficient to form a bajada at the base of the foothills, and flood water is inadequate to mature a crop. Bearing this out, a map . . . prepared from material on Papago farming collected by Clotts (1915) . . . illustrates the heavy concentration of flood water farming in the central and southeastern parts of the Papagueria.

Excavation Methodology

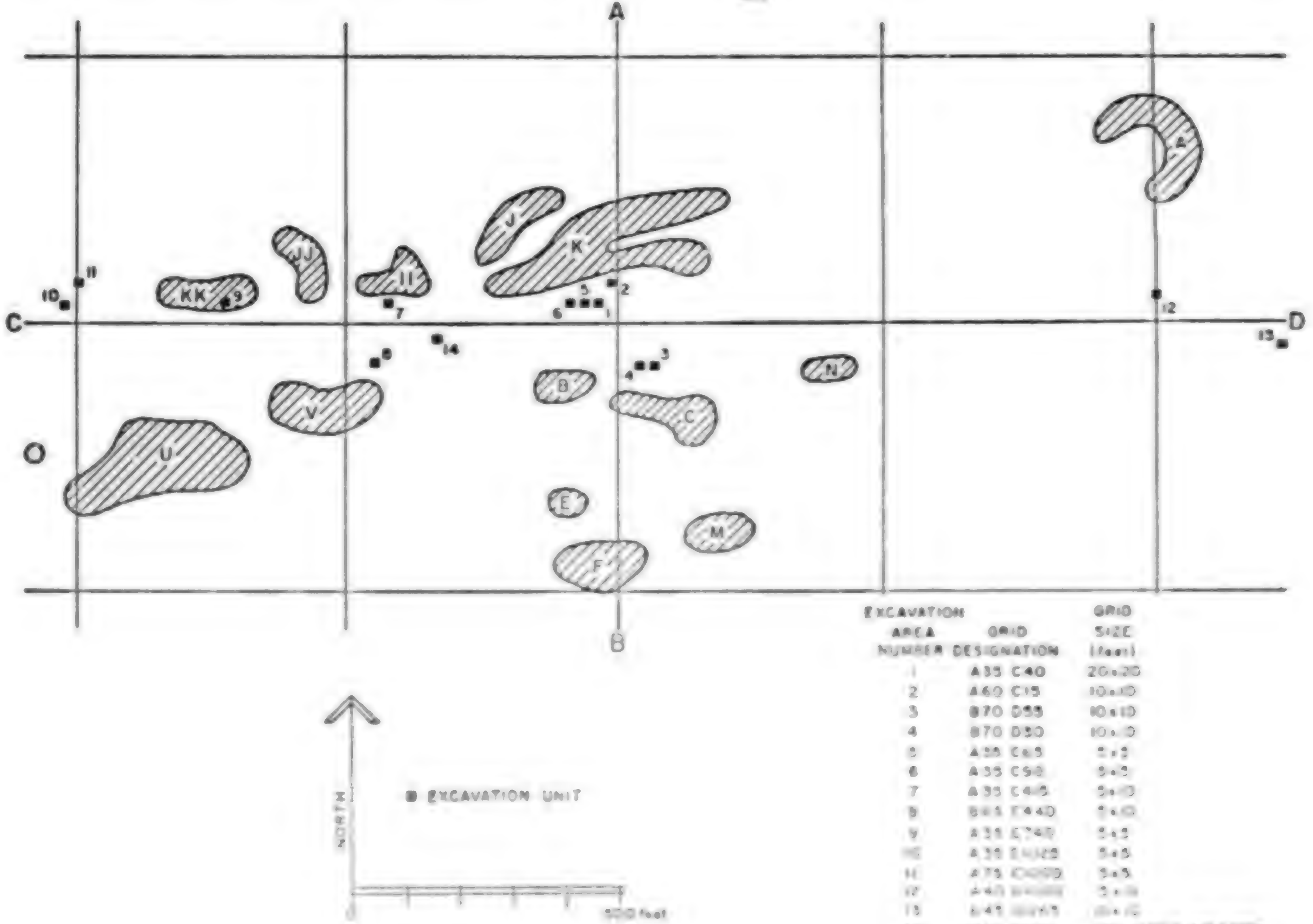
The large size of Gu Achi and the general lack of surface features other than sherd and lithic scatters in the road right-of-way made it necessary to establish a grid system for recording site information. Accordingly, a datum point was established alongside the right-of-way in an area believed to be the approximate center of the site. Two axes were set up from this point. One ran perpendicular to the road (AB axis). The other approximately paralleled the road (CD axis). Point B was established near the banks of Gu Achi Wash, with the axis running north (actually 2° east of north by compass measurement) for 2700 feet (823 m) to point A, a few hundred meters south of Anegam Wash. Point D was established just east of the reservoir (designated Locus A in the author's survey), with the axis running west for 3000 feet (914 m) to Point C, west of Locus U. As loci GG and HH did not lie in the right-of-way, there was no need to extend the CD axis any further west. A Bureau of Indian Affairs road survey crew generously used its transit to place stakes at 100-foot intervals along the two axes. The intersection of the axes was designated point AB-0, CD-0, and all subsequent grid unit designations were assigned in relation to this central point (Fig. 9).

Because surface features were lacking in the right-of-way, a program of combined surface collecting and test excavating was implemented. A series of grids, 25 feet on a side, was established in the right-of-way to facilitate surface collecting. Not all grids were collected, however. The ground surface had been extremely disturbed by a series of drainage ditches that were built to protect the road from flooding and by Stacy's lengthy road grader cut placed in the right-of-way during the testing program. Except for these heavily disturbed areas, most of the grids from 75 feet south of the CD axis (B75) to 50 feet north of the CD axis (A50) and from 500 feet west of the AB axis (C500) to 200 feet east of the AB axis (D200) were intensively collected. In addition, single 25-foot squares were collected at 100-foot intervals along the CD axis from C500 to C1400 and from D200 to D1500. A total of 99 grid squares (16,860 sq. m or 1.42 acres) was surface collected. This is approximately 0.6% of the total surface area (250 acres) of the site.

The collection of these grids was intended to be 100 percent, but field notes indicate that there was difficulty at first in recognizing lithics, and, therefore, certain lithic types, especially cores and debitage, may be underrepresented. Thus, it was noticed during analysis that somewhat greater numbers of lithics were recovered from grid squares during the later stages of surface collection than during earlier ones, regardless of location of these in the site. This possible underrepresentation of lithics should not significantly alter our interpretation of site activities.

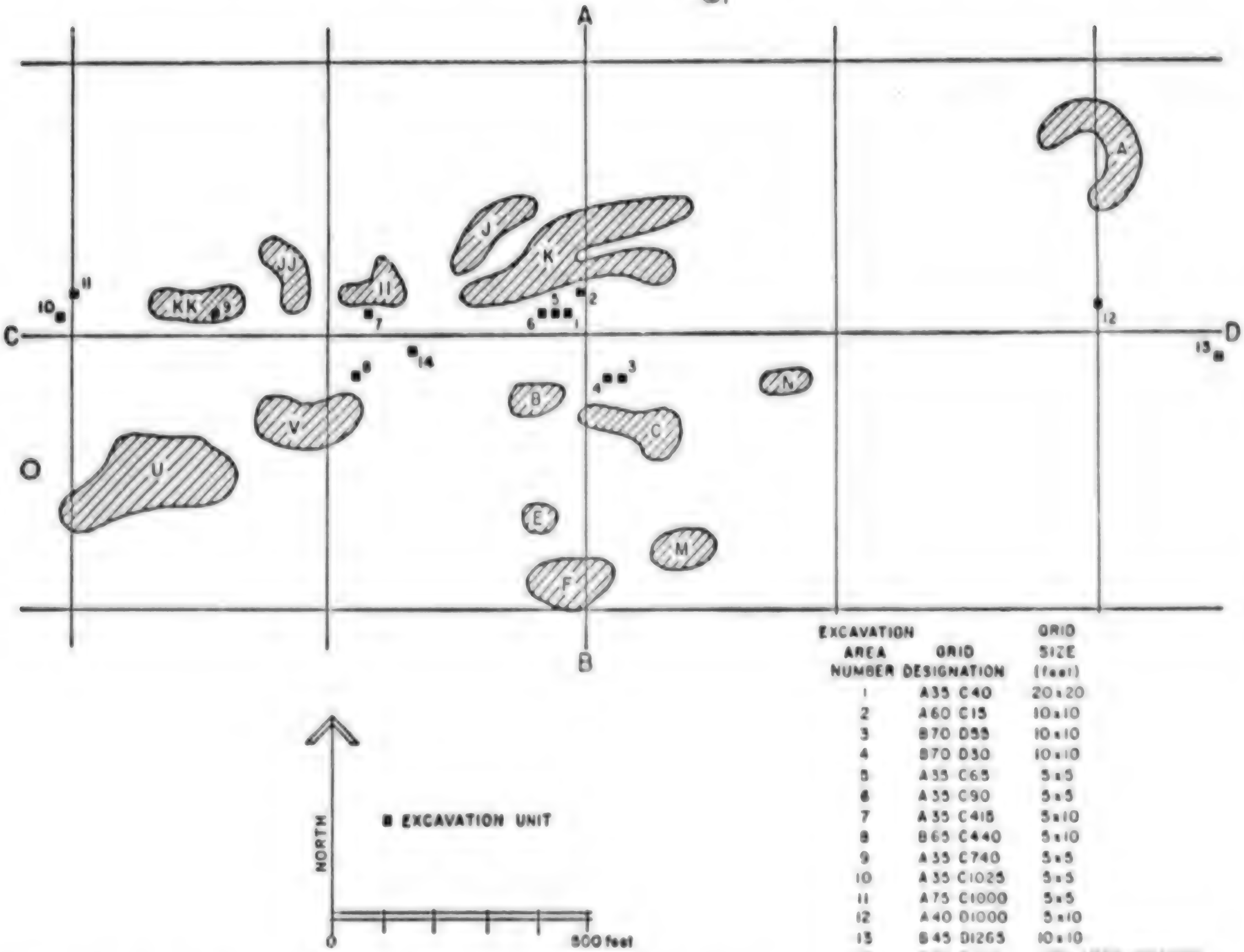
Thirteen grids within the right-of-way were selected for excavation. Most were chosen because of heavy surface concentrations, but four (Excavation Areas 9-12) were purposefully placed in areas nearly free from artifacts. This was done to test the relationship between surface remains and subsurface deposits. This small sample demonstrated that substantial subsurface deposits occurred only in those areas with moderate to heavy surface deposits, notably Excavation Areas 1-6. Excavation Areas 9-12 yielded only a handful of isolated subsurface artifacts. Excavation Area 14 is a large isolated hearth exposed by the road grader cut made by Stacy during the original site survey and testing program in April of 1973. The location of the Excavation Areas with respect to loci recorded during the author's survey is provided in Figure 9.

Excavation grids ranged in size from 5 x 5 feet (Areas 5, 6, 9, 10, 11), to 5 x 10 feet (Areas 7, 8, 12), and to 10 x 10 feet (Areas 2, 3, 4, 13).



EXCAVATION AREA NUMBER	GRID DESIGNATION	GRID SIZE (feet)
1	A35 C40	20x20
2	A60 C15	10x10
3	B70 D55	10x10
4	B70 D50	10x10
5	A35 C65	5x5
6	A35 C50	5x5
7	A35 C45	5x10
8	B65 E440	5x10
9	A35 E740	5x5
10	A35 E1125	5x5
11	A75 C1000	5x5
12	A40 [illegible]	5x10
13	B45 [illegible]	10x10
14	B25 C130	ISOLATED HEARTH

Figure [illegible] [illegible] excavation units in relation to the [illegible]



EXCAVATION AREA NUMBER	GRID DESIGNATION	GRID SIZE (feet)
1	A35 C40	20x20
2	A60 C15	10x10
3	B70 D55	10x10
4	B70 D30	10x10
5	A35 C65	5x5
6	A35 C90	5x5
7	A35 C415	5x10
8	B65 C440	5x10
9	A35 C740	5x5
10	A35 C1025	5x5
11	A75 C1000	5x5
12	A40 D1000	5x10
13	B45 D1265	10x10
14	B25 C330	ISOLATED HEARTH

Figure 9. Map of the excavation units in relation to the loci.

Excavation Area 1 began as a 5 x 5 foot grid but was expanded to more than a 20-foot square area because concentrations of artifacts and features were encountered. Excavation proceeded in 6-inch arbitrary levels except where occupational surfaces were located and followed. Generally, three natural stratigraphic deposits were observed during excavation. The top 1-8 inches consisted of aeolian and sheetwash silts and sands and was generally free from artifacts. This was underlain by a meter-thick layer of brown silts that contained all of the subsurface cultural deposits and, finally, by a sterile basal layer of mixed gravels and silts. The greatest depth at which sterile soil was encountered was 56 inches (1.42 m). Normally it was encountered between 24-42 inches (0.61-1.07 m) below the present ground surface. A total of 90 cubic meters of fill was removed from all excavation units, most of which was sifted with quarter-inch mesh screens. Approximately 365 sq. m of site surface were excavated. This is 0.24% of the areas of artifact concentration (loci), and less than 0.06% of the 150 acres within the site boundaries. Heavy equipment was used only once during the excavation. Because of the pressing time problem, a grader blade was used to remove approximately 0.3 m of overburden above the occupation surface in the southern portion of Excavation Area 1.

The following sections of this chapter deal with the features and artifact associations found in each excavation unit. Analyses of the portable artifacts recovered both during excavation and later survey are given in Chapter 4.

Description of Excavation Units

Excavation Area 1 (A1½ C40)

Excavation Area 1 was the most productive of the grid squares tested at Gu Achi. Excavations in this approximately 20-foot square area recovered a wealth of information pertaining to the late Santa Cruz/early Sacaton phase occupation of the site. In this small area the following features and objects were found: a burned ramada; seven small hearths; five pits--one of which is a large, deep, bell-shaped storage pit; eight large plainware storage vessels--one containing burned corn; an unusual reworked vessel of Trincheras Purple-on-red; 5680 pottery sherds, of which 597 were painted (decorated and redwares); 123 pieces of chipped stone, including 11 tools; one complete mano; 41 specimens of worked shell and shell jewelry; several miscellaneous worked ceramic and stone artifacts; the remains of at least seven different faunal species; and pollen and macrofloral evidence for several economic or nutritionally important plants--domesticates and wild species. Figure 10 shows the location of the major features encountered in Excavation Area 1 (see also Figs. 11-15).

The Ramada. Early in the work on Excavation Area 1, it was noticed that beginning at a depth of approximately 15 cm charcoal and ash became increasingly common. At a depth of 50 cm charcoal and ash were present throughout most of the area. After further work, the stumps of four large burned posts were encountered. These had been set into a compacted occupation surface that extended throughout the entire excavation area at a depth approximately 75-80 cm below the present ground surface (Figs. 11 and 12). The posts averaged 16-17 cm in diameter and were set in holes that extended more than 30 cm below the level of the occupation surface. The posts formed the corners of a square, with each post approximately 2 m from the next (see Figs. 10 and 12).

Identification of the charred posts and presumed roofing material was performed by Dr. William J. Robinson of the Laboratory of Tree-Ring Research at the University of Arizona (Table 4). The four upright posts were mesquite, the wood most commonly used by the historic Pima and Papago Indians for architectural purposes (Bell and Castetter 1937: 42-43) and by the Hohokam in most portions of southern Arizona. In addition, charred fragments of saguaro and ocotillo(?) were scattered on the occupation surface in and around the structure. These almost certainly represent the fabric of the roof and walls (if walls existed). Flotation analysis by Gasser (Appendix A) revealed the presence of charred reeds (*Phragmites communis*), which may also have been used in roof or wall construction. A few chunks of burned clay with reed impressions were found around the structure, most likely resulting from the destruction by fire of the assumed earth-covered roof.

Samples of the burned posts were submitted to the Geochron Laboratories Division in Cambridge, Massachusetts, and to the Laboratory of Isotope Geochemistry at the University of Arizona in Tucson, Arizona, for radiocarbon

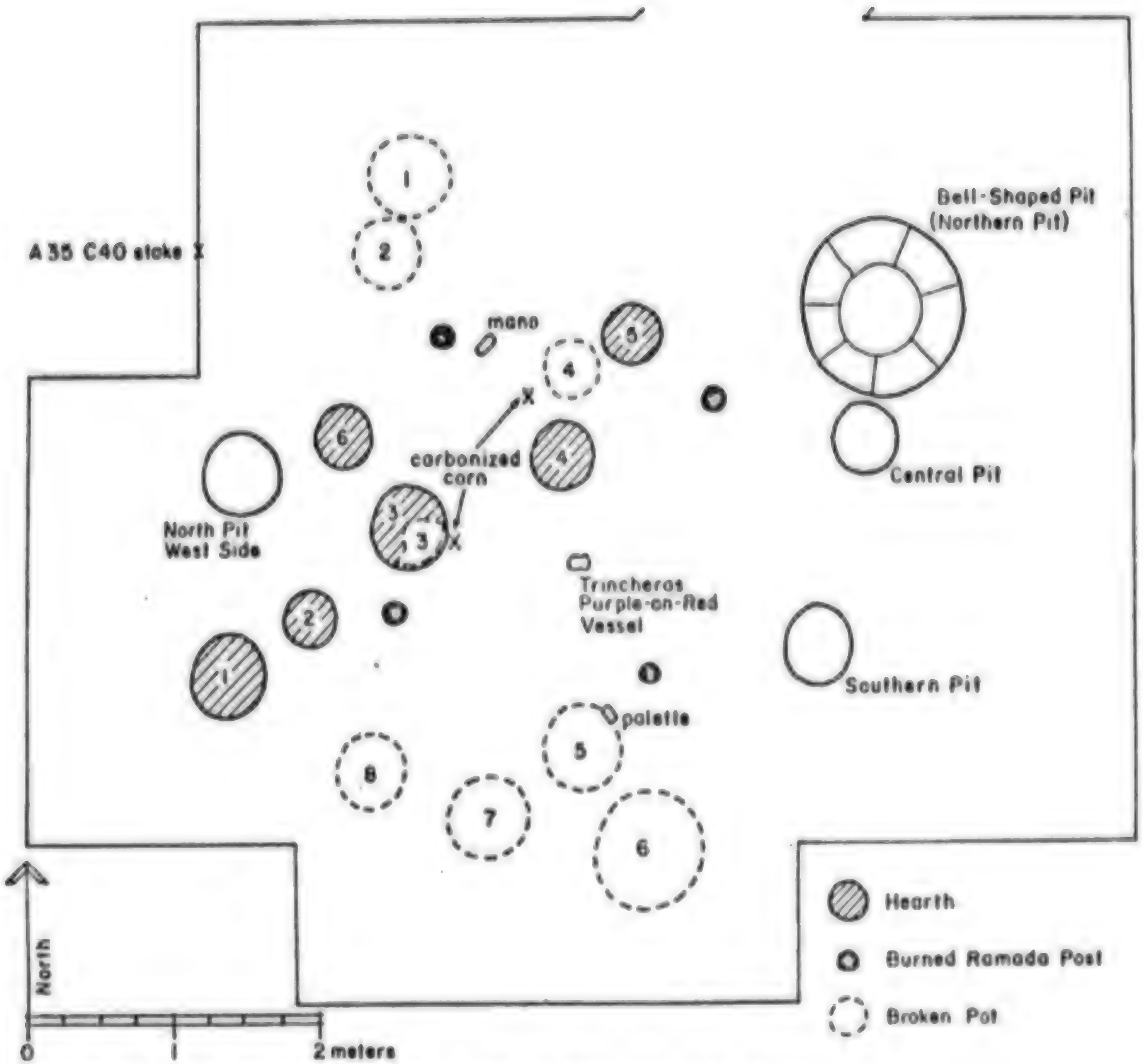


Figure 10. Map of the major features in Excavation Area 1.

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Fig. 11. Excavation Area I occupation surface during excavation, looking south. Note broken plainware storage jar (pot #2) and burned ramada construction material.

Fig. 12. Occupation surface in Excavation Area I, looking south. Burned ramada roof support posts and the bottoms of broken plainware storage jars (pots #5-8) are clearly visible.

	Mesquite	Saguaro	Ocotillo
EXCAVATION AREA 1			
Hearth 1	X		?
Bell-shaped Pit	X		
Around Pots 1, 2	X	X	?
Around Pot 5, 6, 7	X		
Around Pot 8			?
Ramada Posts	X		

Table 4. Species identification of charred wood specimens by provenience.

dating (see Appendix F). Geochron Laboratories reported a date of A.D. 785 ± 130. The Laboratory of Isotope Geochemistry obtained a date of A.D. 1000 ± 80. For several reasons, the latter is the more acceptable date.

Although large numbers of artifacts were found in apparent association with the structure, no architectural features other than the four burned posts and probable burned roof and wall material were encountered. No clay-lined hearths, plastered floors, entryway, or other domiciliary features were found to suggest that this structure served as an actual house. Rather, it appears to have been a ramada ("arbor"). A ramada is an open-air structure, usually having no walls, that is formed by roofing over upright posts with a framework of smaller horizontal beams, brush, and occasionally earth. This structure supplies shade for numerous outdoor activities. An informative description of Pima ramadas by Russell (1908: 155-156) illustates the importance of this type of structure to historic southern Arizona Indians:

> . . . [The arbor] is a cottonwood framework supported by crotched posts, roofed with arrowwood and earth, affording a shade from the sun, from which protection is desirable during the greater part of the year. The roof furnishes a convenient place for drying squashes, melons, fruit, and, in the old days, cotton, where the dogs and poultry can not disturb them. Under its shade the olla of drinking water is set in a crotched post or is suspended from above by a maguey fiber net. Here two

> parallel ropes may be hung and a cloth folded back and forth upon itself across them thus forming an impromptu hammock in which to swing the baby. Here the metate and mortar are usually seen, and here the women sit and weave baskets or perform such other labor as may be done at home. It is the living room through the day the year round, and now that the fear of Apaches has gone it is becoming the sleeping place as well. From a hygienic point of view it is a great pity that the Pimas are learning to build adobes, for the tendency is for them to live indoors and to abandon the healthful arbors, every inch of whose floors is purified by a burning sun that throws its sterilizing rays well under the arbor during the morning and afternoon. . . . The arbor is kept well swept and clean, as is the entire yard about the house, so that a more healthful habitation could not be devised. Occasionally one or more sides of it may be inclosed with arrowwood through which the cool breezes readily find their way.

An instructive photograph of a Sonoran Papago household taken in 1894 by William Dinwiddie is the frontispiece to this volume. A shed made of ocotillo branches (left) and a ramada of upright posts of mesquite and a roof made from ocotillo branches are attached to the adobe brick house. Note the large numbers of pottery vessels, nearby hearth, and other features of interest. If house and shed were removed from the picture, the result would be similar to the scene suggested by the artifactual residue from Excavation Area 1 at Gu Achi.

While the present evidence indicates that the structure in Excavation Area 1 is most likely a ramada, the data is by no means conclusive. For example, Russell talks about and illustrates the use of outdoor kitchens by the Pima Indians (1908: 156-157, Plates VIa and XXXVI). These structures, if used by the Hohokam, could conceivably produce archeological manifestations similar to those in Excavation Area 1. For the sake of clarity and consistency in this report, the structure at Gu Achi will be referred to as a ramada.

Hearths. Seven extramural hearths were located in and around the ramada (Fig. 10). Six were surprisingly uniform in size, ranging in diameter from 30-48 cm and in depth from 5-14 cm. The fill of each contained varying amounts of charcoal and ash, but hearth stones were noticeably absent. The earth surrounding the hearths was only lightly burned, suggesting that the hearths were not used often and that the heat generated by the fire was not intense. Faunal remains were not recovered; because of the small size and shallow nature of the hearths, it is unlikely that the cooking of game was their major function. Four of the hearths (2, 3, 4, 6) contained macrobotanical specimens recovered during the course of Gasser's flotation analysis (Appendix A), including corn kernels, a cholla bud (and four remarkably preserved anthers), a cotton seed, two mesquite pod fragments, and a mesquite seed. These suggest plant processing functions for the hearths, such as parching and roasting. The organic residue still adhering to some sherds found on the occupation surface further suggests boiling activities took place, such as in the making of saguaro syrup (see Figs. 51 and 53).

The final hearth, not shown in Figure 10, was less than a meter west of storage jars 1 and 2. This was a large cone-shaped hearth with a diameter of 1-2 m and a maximum depth of 38 cm. The hearth was filled with large chunks of charcoal (mesquite) and ash, unidentified artiodactyl long bone splinters, and sherds from broken storage jars 1 and 2, which had been disturbed by the hearth. Again, no fire-cracked hearth stones were present. On the basis of stratigraphic evidence, Hearth 7 is more recent than the other features in Excavation Area 1 and may date to the Sells phase occupation at Gu Achi; however, diagnostic Sells phase materials were not encountered in Excavation Area 1.

A radiocarbon date A.D. 550 ± 125 was obtained by Geochron Laboratories Division from charcoal in the fill of Hearth 1. This date does not accord with the other dateable manifestations in Excavation Area 1 and will be discussed more fully later in this report.

As can be seen in Figure 10, the hearths cluster inside and immediately west of the ramada. A brief scan of the archeological and ethnological literature on the use of ramadas (for example Russell 1908; Fontana and others 1962; Goodyear 1975; Doelle 1976) indicates that hearths are rarely or never in direct association with ramadas, but are generally a few meters removed. Thus, it is likely that most of these hearths were not contemporaneous with the ramada. The presence of a pottery vessel (Pot 3), filled with burned corn kernels and resting directly on the charcoal of Hearth 3, suggests contemporaneity for the hearth, the pottery vessel, and the burning of the ramada. If this is the case, then a ramada function, rather than that of a brush kitchen or other walled enclosure, is clearly implied for the structure.

Hearths 1-5 are arranged in a line. Both Doyel (1974: 137-138) and Haury (1976: 155-156) have reported analogous features from other Hohokam sites, with the hearths at the Escalante Ruin (Doyel 1974) more closely matching those at Gu Achi. Haury tentatively suggests that such pits may have been used in the preparation of food or drink, such as saguaro wine.

Pits. Two types of pits were found in Excavation Area 1. Four pits, three of which are illustrated in Figure 10 (Central Pit, Southern Pit, North Pit West Side), are sufficiently similar to be considered a single type. These range in maximum diameter from 51-69 cm and in depth from 15-24 cm. These pits showed no signs of burning and were filled with fine-grained alluvium. The lack of ash and charcoal in these pits suggests that they were in disuse and had been filled with alluvium before the ramada had burned. One pit (not illustrated in Fig. 10) was located northwest of and immediately adjacent to the top of the bell-shaped pit (Fig. 10), which suggests that the bell-shaped pit is an older feature (see Fig. 11).

Few artifacts were found in these pits. Pollen (Appendix C) and flotation analysis (Appendix A) failed to recover any evidence of economically important plants other than a possible pollen grain of *Opuntia* (prickly pear) and several small clusters of Cheno-Am grains from the central pit. The shallow nature of these pits and the lack of floral and artifactual associations suggest that the pits may have been used as pot rests rather than as places for food preparation or storage. Several large storage jars found in situ in similar pits nearby lend support to such an interpretation.

The "bell-shaped" pit in the northeastern corner of Excavation Area 1 (Fig. 14) is thus named because the base of the pit is considerably larger in diameter than the top. The top is 0.56 m in diameter while the bottom is 1.12 m in diameter. The pit is 0.69 m deep. The top is 0.85 m below the ground surface. The pit bottom is flat except for a band around the edge of the pit that is 25 cm wide and recessed about 4 cm. The bell-shaped pit closely resembles prehistoric pit-ovens in southeastern Arizona described by Fulton and Tuthill (1940: Fig. 2). A small amount of ash and charcoal was recovered from the upper fill of the pit, but there were no signs that

Fig. 13. Excavation Area 1 during excavation, looking west. Workers are cleaning pits and hearths in association with the occupation surface.

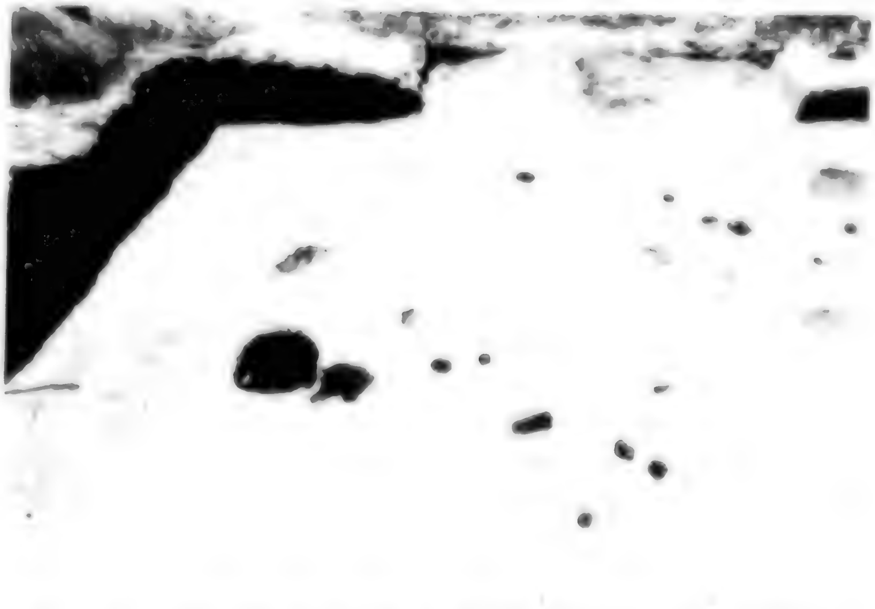

Fig. 14. Excavation Area 1 after excavation, looking south. Large hole in left center is the bell-shaped storage pit.

the pit had been used as a hearth or an oven. A small number of sherds, shell, and fragments of animal bone were scattered in the fill of this feature. There was no fire-cracked stone.

Pollen and flotation analyses of fill from the bottom of the pit yielded one definite pollen grain of corn (Zea) and three corn kernels. Although Haury (1976: 119) suggests that the Hohokam did not employ pit storage, the bell-shaped pit at Gu Achi appears to represent such a function. Evidence from other Hohokam sites outside the Gila River Valley indicates that pit storage may have been commonly practiced (Doyel 1977b: 13-14, 53; Masse in press c; Weed and Ward 1970: 5).

Storage Vessels. Eight plainware pottery storage jars were found in situ on the occupation surface of Excavation Area 1 (Fig. 10). Four of these were clustered just south of the ramada (see Fig. 12), two were found together immediately north of the ramada (see Fig. 15), and the other two were found within the ramada itself. These eight jars constitute four discrete plainware pottery types (crushed altered andesite(?) with schist (3); crushed altered andesite(?) (2); schist polished (2); altered andesitic(?) grus (1)). Size, form, and rim finish are consistent among the types. Vessel diameters range between 70-80+ cm, with rim diameters between 34-56 cm. No accurate measurements of vessel height could be obtained, but it is likely that heights exceeded 75 cm.

One jar (Pot 3) contained 91 ml of charred corn kernels (approximately 485 kernels) and one charred cholla bud; no doubt the charring occurred during the burning of the ramada. Another vessel (Pot 6) contained a possible grain of cotton (Gossypium) pollen and several clusters of Cheno-Ams. Both indicate a storage function for this vessel. The other vessels were apparently empty, but no attempt was made to obtain pollen or flotation samples from them. The clustering of the vessels, the contents of the two vessels, and the large size of the vessels strongly imply that storage was their main function. The frontispiece depicts a similar pattern for the late 19th century Papago.

One of the vessels, a jar tempered with crushed altered andesite(?) with schist and having a diameter of approximately 80 cm, has numerous "drip" marks on its shoulder (Fig. 53). These have been interpreted as the result of boil-over from cooking a sugary substance such as saguaro fruit. Thus, cooking is implied as one function for this vessel. Perhaps some of the other jars in Excavation Area 1 that have been termed "storage" vessels had different functions as well.

Postholes. In addition to the four burned ramada posts, at least 14 postholes were scattered throughout Excavation Area 1. Most of these were 8-10 cm in diameter and had been placed immediately around and to the north of the ramada. Two distinct levels of postholes were encountered during excavation; seven were first noted at a depth of 75-80 cm below the surface, and 13 were encountered at 90-95 cm. While this seems to suggest two components, such was probably not the case. Six of the seven upper "postholes" were actually burned posts (including the four ramada posts), with their tops level with or slightly above the level of the occupation surface. Thus, nearly all of the posts and postholes originated at about the same level. This is not to suggest, however, that they were all contemporaneous.

An attempt was made to see if these postholes formed any meaningful pattern other than the ramada structure itself. No patterns could be found. The postholes may then either represent earlier structures or, more likely, be the product of different sets of activities associated with the use of the ramada. Location of the postholes is not given in Figure 10; this information is on file at the Western Archeological Center.

Two small burned posts are significant because of their relationship to the larger burned ramada posts. These were about 15 cm southeast of the two westernmost ramada posts. Because the smaller posts were burned, they were probably in use at the time the structure burned. While their function is unknown, they may have served as added support to bolster the roof of the structure.

Occupation Surface. As previously noted, a hard-packed layer of earth was one of the first indications of the intensity of occupation in Excavation Area 1. This occupation surface lay at an average of 75-80 cm below the ground surface and extended throughout most of the excavated area. Sterile ground lay approximately 10-25 cm below the occupation surface, but few artifacts were found in this deepest unit compared to those found on or immediately above the occupation surface. The limits of the occupation surface are not known and appear to extend beyond the excavated area to the west and the south. As can be seen in Figure 16, it was not possible to extend the excavation any further south because of the existing roadway. A test trench (Trench A) 1 m wide and 6 m long was placed in the northeast corner of Excavation Area 1 and excavated to the southwest corner of Excavation Area 2. This was done to see whether or not the occupation surface in Excavation Area 1 extended to Excavation Area 2, where additional concentrations of artifacts had been located (Fig. 15). The relationship between the two areas could not be established, but sterile ground was encountered in most of the trench area at a depth of 55-60 cm.

A remarkable number and variety of materials were found in association with the occupation surface in and around the ramada. In addition to the features mentioned above were hundreds of plainware sherds (some possibly from the eight storage jars); 59 buffware sherds, representing 3 or 4 early Sacaton Red-on-buff vessels; 9 chipped stone tools: 6 utilized flakes, 2 cores, 1 unifacially retouched flake; 7 tabular tools; 34 pieces of chipped stone debitage, mainly secondary decortication flakes; 22 pieces of shell--4 *Laevicardium* pendant fragments, 1 *Laevicardium* perforated shell, 2 resist-coated *Laevicardium*, 6 fragments of *Laevicardium* debitage, 1 piece of *Spondylus* debitage, 7 *Glycymeris* bracelet fragments, and 1 ring fragment; an obsidian projectile point; a pumice [illegible]; an incised palette and associated quartz crystal; a possible "awl" and a bighorn sheep bone tube; a reworked Trincheras Purple-on-red vessel; a miniature clay bowl; one complete and one fragmentary mano, a nearly complete handstone; a multipurpose tool of ground and polished diorite; a thin concentration of red ochre, and a possibly associated small layer of ground micaceous schist.

Several observations can be made regarding this assemblage. First, Excavation Area 1 is obviously a place where plant (and probably animal) processing and storage were done. The chipped stone specimens indicate that tool use and tool manufacture took place, though primary reduction of cores was rare. The presence of just a single whole ground stone specimen is somewhat disturbing in that more should be expected under the hypothesis of plant processing. However, it is possible that metates and

Fig. 15. Excavation Area 1 (in foreground), Trench A, and Excavation Area 2, looking northeast.

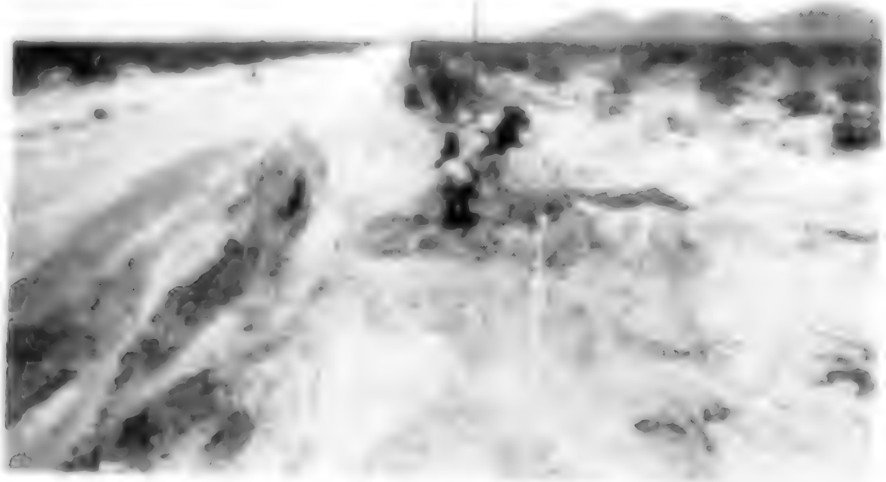

Fig. 16. General view of Gu Achi during excavation, looking east. Workers are clearing overburden from bladed southern portion of Excavation Area 1.

other valuable articles of ground stone have been scavenged from the area since the ramada was destroyed.

The large number of shell specimens strongly implies that shell manufacture was done in this area. It is tempting, but speculative, to link together the resist-coated Laevicardium shell and Hearths 1-3. If the latter were utilized for the fermenting of saguaro juice, and if, as Haury (1976: 318) suggests, soured juice could be used for the etching of shell.

Finally, the close association of a palette, well-used quartz crystal, red ochre, ground micaceous schist, and complete bone tube suggest curing ceremonies or other shamanistic activities. The reworked Trincheras Purple-on-red vessel (Figs. 61, 62) resembles somewhat the "mushroom stones" of Mexico (DeBorhegyi 1963). Whether or not similar magico-religious characteristics were attributed to this vessel by the Hohokam, its unique shape would certainly have made it an object of great curiosity. As an alternative to the obvious shamanistic attributes of these various artifacts, the ochre, micaceous schist, and palette could possibly have been used in pottery making.

Excavation Area 2 (A60 C15)

Two levels of occupation were tentatively identified in Excavation Area 2. These are, however, somewhat poorly understood because the excavated area was small (slightly larger than 9 sq. m). The upper level contained two sizeable hearths and associated material culture. There was no compacted occupation surface, which made it difficult to adequately define and relate the material in this upper level. The two hearths were slightly more than a meter apart and were found at a depth approximately 50 cm below the ground surface. Both hearths were roughly circular, about 1 m in diameter, and contained some charcoal and ash but no fire-cracked stone. The charcoal in Hearth 1 (the northern hearth) was identified as mesquite by Dr. William J. Robinson. Hearth 1 was 43 cm deep while Hearth 2 was slightly more than 30 cm deep. Flotation of the fill of Hearth 1 recovered a single saguaro seed. A radiocarbon sample was also obtained from Hearth 1 and was processed by the Geochron Laboratories Division. The resultant date was A.D. 760 ± 130. This date may be somewhat too early, but it is almost identical to the date reported for the ramada in Excavation Area 1.

Several other objects of material culture were found in probable association with the upper occupation level (see Fig. 17). These include half of a shaped rectangular bifacial mano of vesicular basalt, portions of two metates, a small fragment of a slab metate of rhyolite, and a large chunk of a rhyolitic trough metate. Other artifacts were numerous plainware sherds, 23 buffware sherds (19 unidentified or undecorated, 4 Santa Cruz and Santa Cruz/Sacaton transitional), 3 sherds of Vamori(?) Red-on-brown, 5 pieces of shell (2 Glycymeris bracelet fragments, 1 worked fragment of Laevicardium, and 2 fragments of Laevicardium debitage), two metapudial awls, one unifacially retouched flake, and 14 pieces of chipped stone debitage, mostly secondary and non-cortical flakes.

In addition five postholes were encountered. They seem to originate at this level. The postholes were 8-9 cm in diameter. Three formed a north-south line through Hearth 2. Two of the postholes were 50 cm apart, while the third, which was separated from the others by Hearth 2, was slightly more than a meter to the north. Two more postholes were located 50 cm from each other immediately northeast of Hearth 2.

The lower occupation surface was defined approximately 96 cm below the ground surface. This surface was hard packed and burned and was covered with a layer of ash nearly 10 cm in thickness. This surface covered much of the eastern half of the excavated unit, being about 50 cm in width (east-west) and almost 3 m in length (north-south). Because of time limitations no attempt was made to further explore and define this feature. Sterile ground appeared immediately below or within a few centimeters of this occupation surface.

The lower occupation level in Excavation Area 2 contained an array of artifacts similar to the upper level, but no postholes or hearths were encountered. Artifacts included hundreds of plainware sherds, 38 buffware sherds (30 undecorated or unidentified, 1 Sacaton Red-on-buff, 1 Santa Cruz Red-on-buff, 6 transitional Santa Cruz/Sacaton Red-on-buff), a bone "fleshing" tool, 13 pieces of shell (3 Glycymeris bracelet fragments, one of which had been reworked, 1 Glycymeris whole shell bead, 1 fragment of Glycymeris debitage, 2 worked fragments of Laevicardium, 6 pieces of Laevicardium debitage), and 11 pieces of chipped stone debitage. In addition the field notes mention a possible metate on the lower occupation surface, but apparently this specimen was not collected. Ash covered and surrounded this specimen, but was not found under it.

The prehistoric activities carried out in Excavation Area 2 seem similar to those of Excavation Area 1. The hearths and postholes of the upper level certainly resemble those of Excavation Area 1, and it is likely that the burned surface of the lower occupation level represents a burned pit house or ramada structure. The two levels appear to be roughly contemporaneous on the basis of the associated decorated ceramics, and yet they are separated by nearly 35 cm of trashy fill. The reason for such an extensive build-up of fill in a seemingly short period of time is at present unknown.

Trench A. A 0.5 m x 8 m trench was excavated to connect Excavation Areas 1 and 2 in order to relate the various occupational surfaces (Fig. 16). This attempt was unsuccessful in that the respective occupation surfaces were either circumscribed or discontinuous and did not extend the length of the trench. Sterile soil was reached in Trench A approximately 80 cm below the ground surface, slightly higher than in either of the excavation areas. The greatest concentration of cultural materials was found 30-40 cm below the ground surface in the south-central portion of the trench. This suggests an affinity with the upper occupation level in Excavation Area 2.

Excavation Area 3 (B70 D55)

Excavation Area 3 was on the south side of Pit 16, about 35 m southeast of Excavation Area 1. A 9 sq. m area was excavated to sterile, which was reached between 60-70 cm below the ground surface. At a depth of about 29 cm, the top portion of a burned skull and horn core from a bighorn sheep was encountered. This feature rested on a presumed occupation surface about 41 cm below the ground surface. The occupation surface was not a compacted earth layer; rather, this surface was determined by the distribution of artifacts. Overturned next to the bighorn sheep skull was most of a trough metate that had been split longitudinally. This metate [illegible] not in the site collections; however, an in situ photograph (Fig. 19) [illegible] verification of

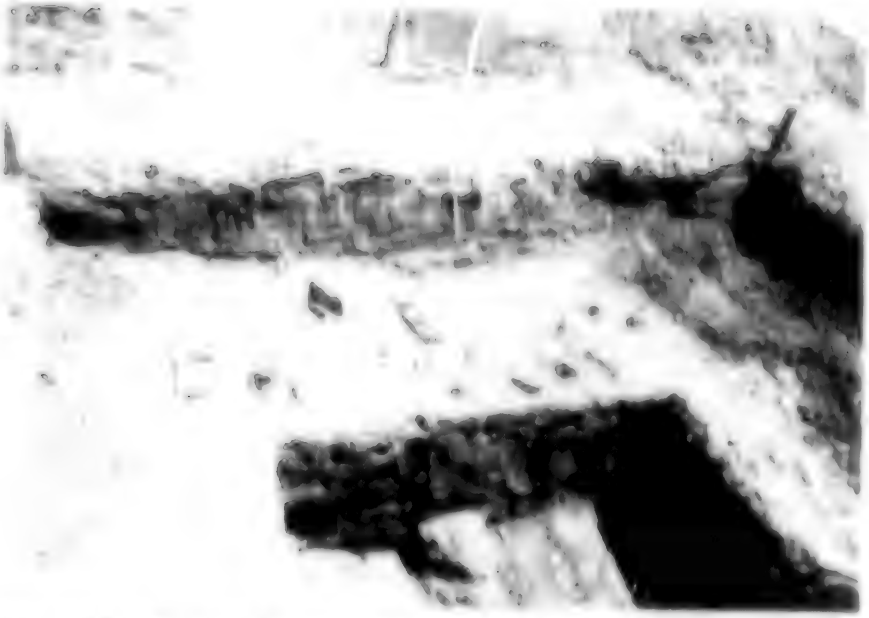

Fig. 17. Possible occupation surfaces exposed in the northern portion of Excavation Area 2. North arrow rests on upper occupation level; bottom of excavated unit in foreground is the lower occupation level.

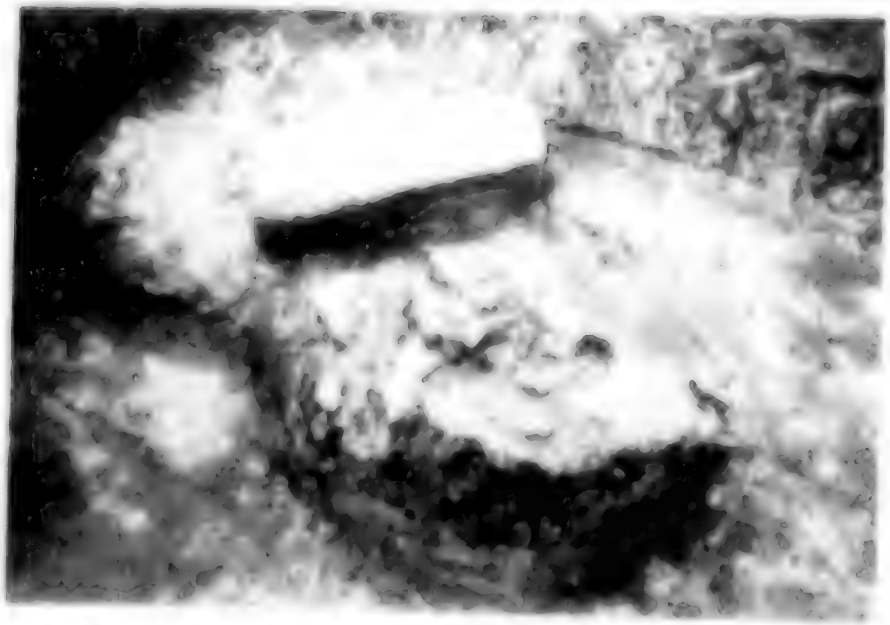

Fig. 18. Burned bighorn sheep horn core and inverted broken metate on occupation surface in Excavation Area 3.

the excavations suggest that it was manufactured from a substance such as rhyolite and not vesicular basalt. Several small chunks of fire-cracked vesicular basalt were found in association with the bighorn sheep skull and metate. These appear to have been scattered over the occupation surface along with some ash and flecks of charcoal.

Other artifacts found in probable association with the occupation surface include a unifacially retouched flake, 13 pieces of chipped stone debitage (mainly secondary decortication flakes and chunks), a bone tube fragment, an awl(?) fragment, three pieces of worked shell (including a lizard(?) pendant of *Laevicardium*, 1 worked *Laevicardium* fragment, and 1 pecten whole shell pendant fragment), numerous plainware sherds, and 27 buffware sherds. Only one buffware sherd could be identified as to type (Gila Butte Red-on-buff). This made the dating of this occupation surface difficult. However, the upper levels of Excavation Area 3 yielded 161 buffware sherds, of which two were Sacaton Red-on-buff and six were Santa Cruz Red-on-buff. Thus, the occupation surface is most likely not more recent than the transition between the Santa Cruz and Sacaton phases.

Excavation Area 4 (B70 D30)

Excavation Area 4 is about 6 m east of Excavation Area 3. This location was tested because of a surface scattering of fire-cracked cobbles. Subsequent excavation of a 9 sq. m area revealed no subsurface depth of the cobble deposits. In fact, the only subsurface stratigraphy of note was a layer of charcoal and ash in the northern portion of the unit, observed at a depth of 40-45 cm. That this charcoal layer is at approximately the same depth as the occupation layer in Excavation Area 3 is most likely significant. The remains of several faunal species were either associated with this layer or immediately above it (see Appendix D, Table 27). Sterile was reached at a depth of roughly 65-70 cm.

Two chipped stone tools, a utilized flake and a retouched flake, and two pieces of shell (worked *Glycymeris* fragment and *Spondylus* debitage) were found in association with the charcoal layer. A squarish platelet of micaceous schist, the edges of which have been ground, was also found. This may have been part of a mosaic. Two distinctive Hohokam projectile points were recovered near the charcoal layer. A fragment of a carved stone ring or disc made from reddish-brown pumice (see Fig. 83a) was found slightly above the charcoal. The ceramics found in possible association with the charcoal layer include 21 buffware sherds, of which three are Santa Cruz Red-on-buff and one Gila Butte Red-on-buff. The ceramics and projectile points suggest a Santa Cruz phase assignment for the activities associated with the charcoal layer.

Excavation Area 5 (A35 C65)

Excavation Area 5 is 6 m west of Excavation Area 1. Because of the proximity of these two areas, it was expected that Excavation Area 5 would produce manifestations similar to those of Excavation Area 1. However, the problems of interpreting a 2.25 sq. m excavation unit are great. Two stratigraphic features were noted during excavation. First was a thin layer of charcoal at a depth of 15 cm. At a depth of 75-80 cm charcoal was noted over much of the southeastern portion of the excavation unit. Both layers of charcoal correspond to levels in Excavation Area 1. The lower layer indicates that this occupation level is most likely quite extensive throughout this part of Gu Achi. Sterile was reached at a depth of 90 cm. The only decorated ceramics associated with the major occupation level (75-80 cm) were two sherds of transitional Santa Cruz/Sacaton Red-on-buff. This agrees with the dating of Excavation Area 1.

Excavation Area 6 (A35 C90)

This 2.25 sq. m excavation grid lies 6 m west of Excavation Area 5 and 14 m west of Excavation Area 1. Evidence from this unit suggests that the occupation level associated with the ramada did not extend this far. Sterile was reached at a depth of 60 cm. Immediately above sterile was a thin layer of charcoal and ash, especially in the northern portion of the unit. Very few artifacts were associated with this layer, and it cannot be satisfactorily related to the occupation layer in excavation units to the east.

Excavation Area 6 contained a possible hearth, the top of which first appeared at a depth of 20 cm. The dimensions of this feature were not recorded, but it was noted that some small cobbles were admixed with the charcoal and ash. Two flotation samples were processed from the fill of this hearth, but no economic information was obtained. A single sherd of Santa Cruz Red-on-buff was found in the levels between the hearth and the charcoal layer. This sherd and the 10 sherds of transitional Santa Cruz Red-on-buff found in the highest level (0-15 cm) suggest a Santa Cruz or transitional Santa Cruz/Sacaton phase date for the hearth and the earlier charcoal layer.

Excavation Area 7 (A35 C415)

All cultural material in this 1.5 x 3.0 m (5 x 10 ft) excavation unit was recovered from the top 15 cm. While no temporally diagnostic artifacts were recovered, the general appearance of the ceramics suggests a Santa Cruz/Sacaton phase date.

Excavation Area 8 (B65 C440)

This 1.5 x 3.0 m excavation unit is located approximately 30 m south of Excavation Area 7, and, as in the previous unit, all cultural materials were confined to the upper 15 cm. A handful of unidentifable and undecorated buffwares and other aspects of the assemblage indicate a Santa Cruz/Sacaton phase date.

Excavation Area 9 (A35 C740)

Excavation Areas 9-12 were selected for work because of a general lack of surface manifestations. The purpose of excavation was to test the relationship between the density of surface artifact concentration and subsurface remains. Excavation Area 9 was placed within or next to a surface trash concentration (Locus KK) defined in the author's survey of Gu Achi. However, Locus KK had a light surface concentration, and Excavation Area 9 was placed in an area where the surface concentration was indeed minimal.

The few artifacts recovered from Excavation Area 9 were all from the upper 15 cm. These were neither temporally nor culturally diagnostic but proximity to Locus KK suggests a Santa Cruz/Sacaton phase date.

Excavation Area 10 (A35 C1025)

The only artifacts encountered in the testing of this unit were two sand-tempered plainware sherds found at a depth of 43 cm. It was not noted in the field whether these were found in a rodent burrow; thus, we are left to speculate on their origin. One of the sherds has a distinct Classic period shoulder, and both may be eroded samples from a Tanque Verde Red-on-brown jar.

Excavation Area 11 (A75 C1000)

Testing of Excavation Area 11 resulted in a handful of artifacts. Most of these were found in the upper 15 cm though testing extended to a depth of approximately 30 cm. The only diagnostic artifact is a single decorated sherd of Trincheras Purple-on-red.

Excavation Area 12 (A40 D1000)

Excavation Area 12 was placed some 50 m south of the reservoir (Locus A). A small amount of artifactual material was located in the upper 15 cm of this unit. One unidentified and one undecorated buffware sherd are the only culturally diagnostic items. A complete unifacial rectangular mano made from a granitic type of stone was also found.

Excavation Area 13 (B45 D1265)

Excavation Area 13 was so placed because of surface indications of a possible hearth. In order to understand this feature better a 9 sq. m area was tested. Excavation revealed that the hearth was approximately 1-2 m in diameter and 15 cm in total depth. However, a few modern items found in association strongly suggest that the hearth is of recent construction. A few prehistoric artifacts were recovered in the upper 15 cm, including a fragment of a trough or basin metate. Most of the accompanying prehistoric ceramics are white-schist-tempered plainwares, indicating a Classic period date.

Excavation Area 14 (B25 C350)

A hearth partially exposed by the road grader during the survey testing of Gu Achi was tested and given the designation Excavation Area 14. There is no record of the excavation of this hearth, but it was most likely greater than 1 m in diameter and probably contained fire-cracked stone (John B. Clonts: personal communication). A large number of sherds, most of them obviously burned, were recovered from the fill. Four were buffwares, suggesting a pre-Classic use of the hearth. This dating is further strengthened by the location of Excavation Area 14, surrounded on all sides by predominately Santa Cruz/Sacaton phase surface trash concentrations. Other items of interest include an unburned *Glycymeris* bracelet fragment, a small unburned awl(?) fragment, and one piece of debitage. Two charred cotton seeds and four charred mesquite pods were discovered here.

Stacy's notes on the exposure and excavation of another hearth during the initial survey and testing program have been lost. Inspection of this feature during the excavation program indicated that it was over 2 m in diameter (John B. Clonts 1973: field notes).

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Chapter V

THE SURVEY OF GU ACHI

Survey Background and Methodology

Because of time and budgetary limitations, a comprehensive survey of Gu Achi and its environs was not undertaken during the 1975 fieldwork. Some attempt at survey outside the highway right-of-way was made, however. A partial field map made in 1975 shows the location of several features, including several trash concentrations, the reservoir, and the trash mound (field notes are on file at the Western Archeological Center). In addition, casual inspection indicated that the site extended several kilometers along Gu Achi Wash and spanned nearly the entire distance between Gu Achi and Anegam Washes.

The author conducted several brief but intensive surveys of the site and some of the surrounding terrain between the summer of 1977 and the spring of 1978. More than 75 hours were spent surveying the approximately 230 acres of site area. A brief inspection of a few hundred meters north of Anegam Wash, south of Gu Achi Wash, and west to the Black Hills (see Fig. 1) was also accomplished. In addition, the site was visited on various occasions in the company of Emil W. Haury, John W. Clonts, Alan Ferg, David R. Wilcox, and Robert E. Gasser. These individuals confirmed the author's identification of several anomalous features at the site and provided additional useful observations and interpretations that are incorporated into this report.

The survey and site visits addressed three major problems that arose from examination of the excavation notes and materials. (1) What were the boundaries of the site? (2) What spatial/temporal/behavioral patterns could be elicited from a study of surface distribution of artifacts and features, and could the results of the survey be integrated with the information obtained during the excavation to provide a holistic picture of intrasite

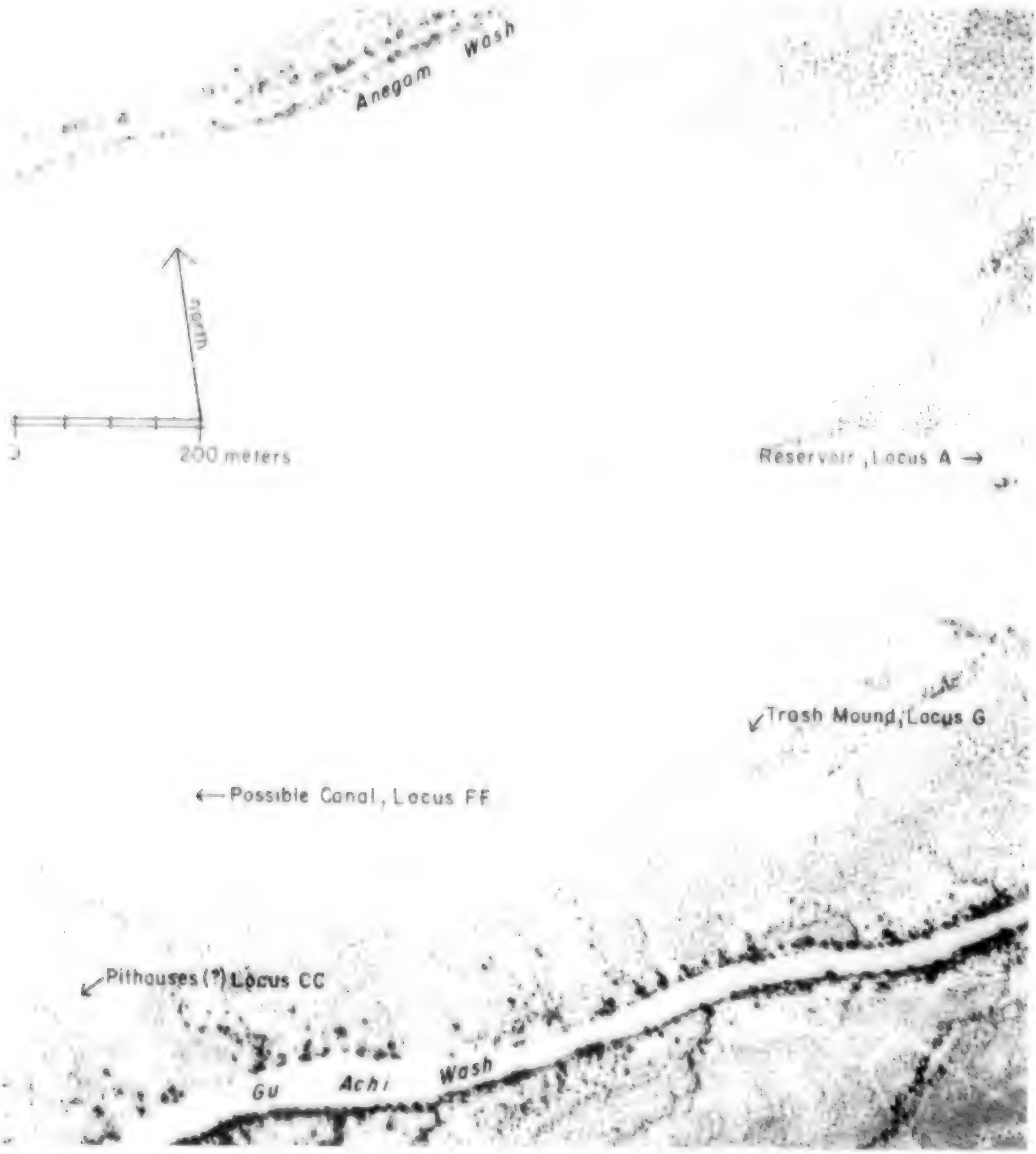

Figure 10. Aerial photograph of Gu Achi taken in 1975. (Courtesy of the Arizona Department of Transportation and the Bureau of Indian Affairs, Phoenix Area Office, Branch of Roads).

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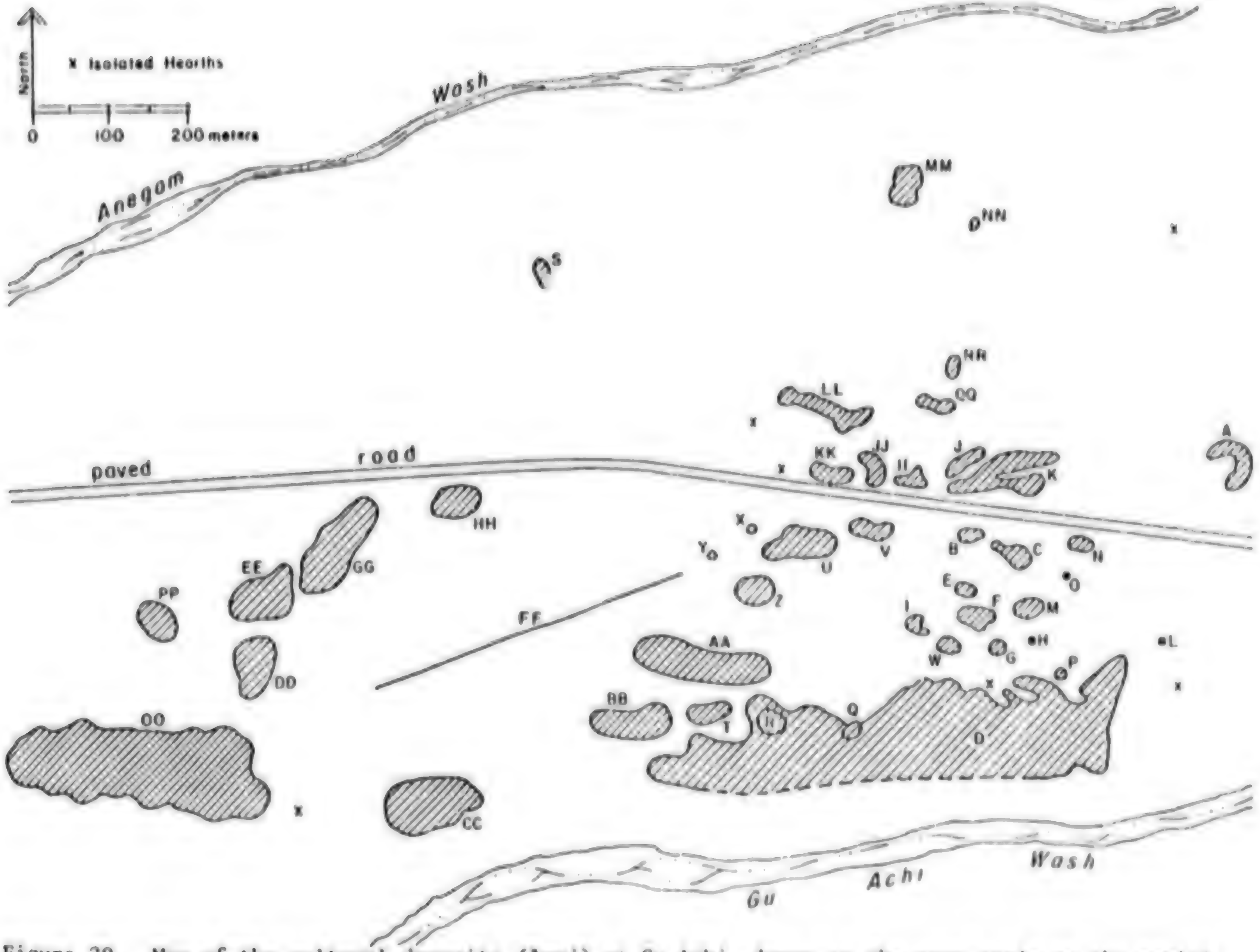

Figure 20. Map of the cultural deposits (loci) at Gu Achi, drawn to the same scale as the aerial photograph.

settlement patterns and culture history? (3) How did the site articulate with its surrounding physical environment? This third question has already been partially discussed in Chapter 2.

Forty-four discrete surface features were recorded during the course of [illegible] (Loci A-RR). Among these were the reservoir, one definite and two possible trash mounds, probable eroded pit houses, a possible canal, crema[illegible], isolated hearths, and numerous sherd and lithic scatters as small as [illegible] m to as large as 60,000 sq. m. Some of these sherd and lithic scatters may represent small agricultural processing camps from the Classic period, but most of them appear to be the remains of pre-Classic period Hohokam habitation and work areas.

The 44 loci were plotted on aerial photographs taken by the Arizona Department of Transportation in March of 1971 and supplied through the courtesy of the Bureau of Indian Affairs. An aerial photograph of Gu Achi is included here as Figure 19, along with a map, drawn to the same scale, that shows the location of all 44 loci (Fig. 20). Clearly visible on this photograph are the reservoir (Locus A), definite trash mound (Locus G), and possible canal (Locus FF). The appearance of the creosote plain, the size difference between Gu Achi and Anegam Washes, and the dendritic pattern of the small, active erosional channels draining into the two washes are also noteworthy.

The loci boundaries depicted in Figure 20 are by no means absolute. For sherd and lithic scatters boundaries were usually determined by densities of artifacts. Three relative categories were used to define artifact densities--heavy, moderate, and light. "Heavy" refers to scatters with an average of more than 50 artifacts per sq. m. Figure 21 is a close-up of a typical pre-Classic period heavy sherd and lithic scatter (Locus U) that has an estimated 125 artifacts per sq. m in the area depicted in the photograph. As can be seen in this photograph, ceramics are numerically the most common artifact class, with somewhat smaller numbers of chipped stone specimens and chunks of burned vesicular basalt hearthstones. "Medium" sherd and lithic scatters average between 15-50 artifacts per sq. m while "light" densities average between 5-15 artifacts. These three levels of artifact density were assigned on the basis of visual impression, but

[illegible]

[illegible]

[illegible]

[illegible]

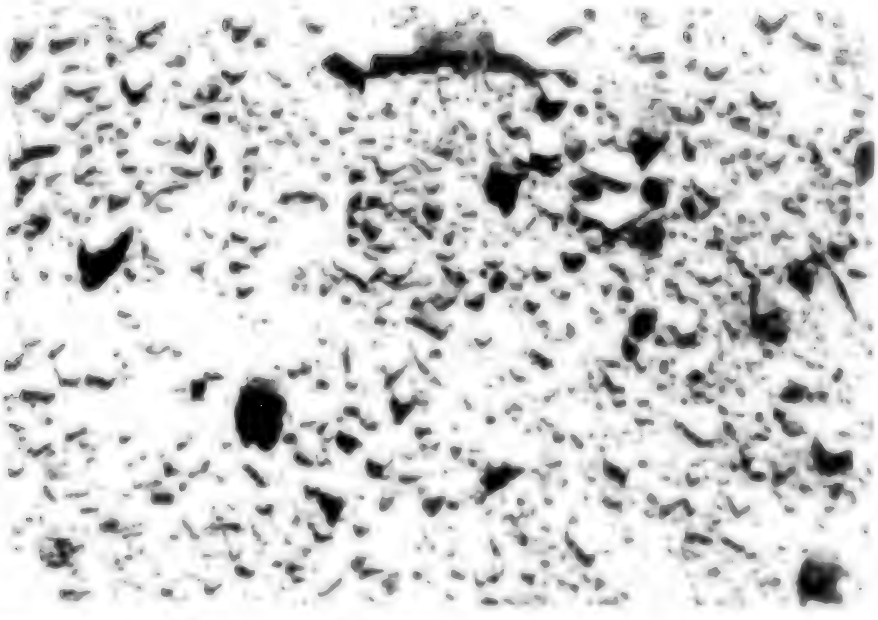

Fig. 21. Close-up of heavy cultural concentration in [illegible] 8C

LOCUS	AREA (square meters)	DENSITY OF TRASH	TIME PERIOD OF MAJOR USAGE	COMMENTS
A	3250	heavy	Santa Cruz/ Sacaton	reservoir
B	450	moderate	Santa Cruz/ Sacaton	possible trash mound
C	600	moderate	Santa Cruz/ Sacaton	
D	60000	moderate to heavy	Snaketown/ Gila Butte	earliest Locus at Gu Achi, cremations present
E	300	light to moderate	Santa Cruz/ Sacaton	
F	1100	moderate to heavy	Gila Butte/ Santa Cruz	
G	250	heavy	Santa Cruz/ Sacaton	trash mound
H	10	heavy	Sells	processing camp
I	400	moderate to heavy	Santa Cruz/ Sacaton	possible trash mound
J	600	heavy	Santa Cruz/ Sacaton	
K	3200	heavy	Santa Cruz/ Sacaton	
L	-----	-----	Sells (?)	isolated hearths
M	450	light to moderate	Snaketown/ Santa Cruz	
N	350	light	Santa Cruz/ Sacaton (?)	
O	10	moderate	Santa Cruz/ Sacaton (?)	processing area(?)
P	100	moderate	Santa Cruz/ Sacaton (?)	
Q	250	heavy	Santa Cruz/ Sacaton	
R	850	heavy	Santa Cruz Sacaton	compact occupation surface at depth of 40 cm; cremation present
S	350	moderate	Sells	processing camp
T	850	heavy	Sacaton	
U	3200	light to heavy	Gila Butte/ Sacaton	

Table 3. Summary of loci identified by surface survey.

V	900	moderate to heavy	Gila Butte/ Sacaton	
W	450	light	Gila Butte/ Santa Cruz	
X	50	moderate	Sells	processing camp(?)
Y	100	moderate	Sells	processing camp
Z	1500	light to moderate	Gila Butte/ Sacaton	
AA	7000	light to moderate	Gila Butte	
BB	3500	moderate to heavy	Gila Butte	
CC	6500	moderate to heavy	Gila Butte/ Santa Cruz	possible [illegible] pit house
DD	3400	moderate to heavy	Santa Cruz/ Sacaton	cultural layer at depth of 45 cm; cremation present
EE	4000	light to heavy	Gila Butte/ Santa Cruz	
FF	----	--------	--------	possible canal
GG	6000	moderate to heavy	Santa Cruz/ Sacaton	
HH	1800	moderate to heavy	Santa Cruz	
II	450	light to moderate	Santa Cruz/ Sacaton	
JJ	750	light to moderate	Santa Cruz/ Sacaton	
KK	850	light to moderate	Santa Cruz/ Sacaton	
LL	2300	light to moderate	Sells	processing camp
MM	1800	light to heavy	Sells	processing camp
NN	100	moderate	Santa Cruz/ Sacaton	processing camp(?)
OO	33000	light to heavy	Santa Cruz	cultural layer at depth of 40 cm
PP	2400	light to moderate	Santa Cruz	
QQ	400	light to heavy	Santa Cruz/ Sacaton	cultural layers extend to depth of 40 cm
RR	200	light	Santa Cruz Sacaton	

Table 5. (continued)

library for the interested reader. The following discussion groups the loci into three temporal divisions. First is the transitional Snaketown/Gila Butte phase occupational area that is almost solely confined to Locus D. The second contains all loci dating from the Gila Butte through the Sacaton phases, which includes 36 of the 44 site loci. Many of these loci appear to date to the transition between the Santa Cruz and Sacaton phases, but the similarity of these loci and those of Gila Butte and early Santa Cruz phase age makes separate discussion unnecessary. The third temporal division includes several loci that date to the Classic period Sells phase. The pre-Classic period Hohokam loci most likely are the remains of actual habitation areas while the Sells phase loci appear to be specialized agriculturally related processing camps.

Transitional Snaketown/Gila Butte Phase Loci

The large area designated Locus D contains the earliest evidence of occupation at Gu Achi. This area, extending along Gu Achi Wash for a distance of over 600 m, includes some 60,000 sq. m of cultural concentration. On the site map (Fig. 20), the southern boundary of Locus D is depicted by a dashed line because of the greatly dissected and deflated nature of the terrain near the wash. This ongoing erosion has helped to reveal much of the extent, depth, and nature of these important cultural deposits. Unfortunately, though, several hundred cubic meters of deposits have either been moved from their original context and redeposited or have been entirely washed away.

Most of the earliest artifactual material, dating from the transition between the Snaketown and Gila Butte phases, was found in the eastern half of Locus D in an area of approximately 35,000 sq. m. While material from this time period was also observed in the western portion of the locus, late Gila Butte through early Sacaton phase material, such as that occurring in Loci Q and R, seemed to predominate there.

An erosion channel trending to the south has exposed most of the early cultural material described in this report (Fig. 23). The head of the channel lies approximately 100 m due south of the trash mound, Locus G. Comparison of the present situation with that depicted in the aerial photograph taken in 1973 indicates that the head of the channel has moved almost 10 m closer to the trash mound in approximately five years.

No excavations were undertaken in the earliest component at Gu Achi because it lay outside the road right-of-way. Thus, interpretation of the nature of deposits from this time period is based mainly on observations made during the course of the survey. Because of the rapid degradation of this portion of Locus D, selected ceramics, chipped stone, and shell were collected from several locations for comparison with materials excavated in 1973. These surface collection areas are shown in Figure 22.

In all collection areas, the predominant decorated ware was either a late style of Snaketown Red-on-buff or an early style of Gila Butte Red-on-buff (Figs. 54, 55). Collection Area 1 (Fig. 24), a heavily deflated portion of Locus D, exemplified manifestations of this early time period. Large numbers of Snaketown Red-on-buff sherds from several different vessels were concentrated in an area roughly five m in diameter (Fig. 25). The attributes of these sherds were identical to those seen at Snaketown in the Gila Basin. On the basis of both macroscopic and petrographic analyses (Appendix G), it seems likely that the decorated Gu Achi ceramics are imports from the Gila Basin. Plainwares, likewise, show a strong resemblance to Gila Basin specimens in both technological and stylistic attributes. The major difference concerns tempering agents. In spite of the thousands of late Pioneer and early Colonial period sherds observed in Locus D, only a single intrusive non-Hohokam specimen, a jar sherd of the non-specular variety of Trincheras Purple-on-red, was noted (Fig. 63d). Gu Achi lacks intrusive ceramics during the late Snaketown and early Gila Butte phases, as do most other early Hohokam sites (Masse: n.d.b).

Chipped stone was abundant throughout most portions of Locus D. Green quartzite was the preferred material even at this early date, but basalt and other volcanics were represented in somewhat higher percentages than in portions of Gu Achi of a later date. Several unifacially retouched flakes, most with steep edge angles, were scattered throughout the area. Fist-sized hammerstones and many fragments of worked tabular schist were also encountered. A tabular schist "mescal knife" (Fig. 75i) was discovered about 30 m east of Collection Area 7. This specimen is possibly intrusive from later Santa

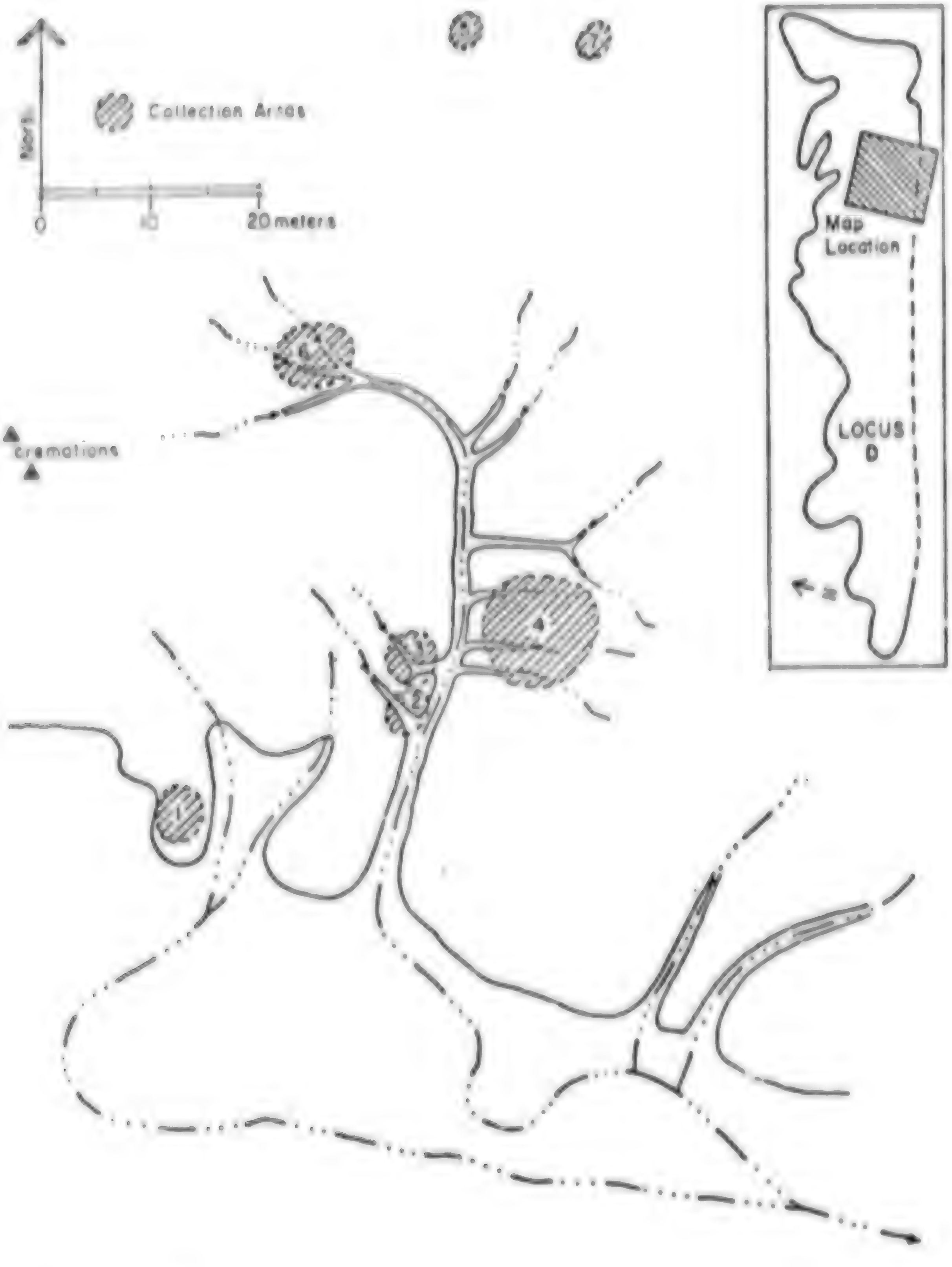

Figure 22. Map of the collection areas in Locus D.

Cruz/Sacaton or Sells phase occupation of the site. Other types of tools, such as gravers and denticulates, were not found, but their absence most likely reflects the nature of inspection during the course of the survey. A single projectile point that corresponds closely to early Hohokam point types at Snaketown and Ventana Cave was found at Locus D (Fig. 6b).

Ground stone was well represented, with manos and metates encountered throughout Locus D. Most specimens were made from vesicular basalt; a few were gneiss or granite. Of the 15 fragments of metates identifiable as to type, six were troughs. In addition, most of the manos were of the shaped rectangular style. According to Haury (Haury and others 1950: 316; Haury 1976: 282), the trough metate/rectangular mano complex indicates maize production.

Fire-cracked chunks of unworked vesicular basalt were liberally scattered over the surface of Locus D. Most specimens appear to have been deposited as trash; occasional clusters, however, indicated in situ hearths. No habitation structures were noted in Locus D, but brief testing in Locus D revealed a compact occupation surface on which several chipped and ground stone specimens, large plainware jar sherds, and shell were found.

No in situ burials were encountered in the eroded portions of Locus D though surface indications suggested the presence of cremations. A burned complete human metacarpal was located in Collection Area 4. Two separate concentrations of cremated human cranium were also noted approximately 40 m west of Collection Area 4 (Fig. 22). In neither case were artifacts directly associated with the bone.

Locus H also exhibited some materials dating to the transition between the Snaketown and Gila Butte phases. At this locus were single sherds each of stylistically late Snaketown Red-on-buff, Gila Butte Red-on-buff, and early Santa Cruz Red-on-buff. Unidentified and eroded buffware were not as common as might be expected if the major usage of the locus were during the late Santa Cruz and Sacaton phases. Two sherds of Vahki Red and several thin-walled plainware specimens further indicate that a substantial amount of the material at Locus H dates to the late Snaketown and Gila Butte phases.

Fig. 23. View of northern portion of Locus P, looking south toward Gu Achi Wash, showing head-cutting area of an erosional channel (between Collection Areas 4 and 6).

Fig. 24. Southern portion of Locus P (Collection Area 1).

Fig. 25. Close-up of Fig. 24. Note Late Pioneer period ceramics in situ.

Fig. 26. Locus M (center of photograph), looking northeast toward the Sheridan Mountains.

Gila Butte Through Sacaton Phase Loci

Most of the loci at Gu Achi date to the Gila Butte through early Sacaton phases. As previously mentioned, the general similarity among these loci makes their detailed description unnecessary, although a few of the more notable ones will be discussed at length. The loci that are given individual attention include the reservoir (Locus A), the one definite trash mound (Locus G), the possible canal (Locus FF), the area of probable pit houses (Locus CC), the two Santa Cruz/Sacaton phase enclaves in Locus D (Loci Q, R), an eroded area of deeply buried cultural deposits in the western portion of the site (Loci DD, EE, OO), and two small sherd and lithic scatters that may be agricultural processing camps (Loci NN, O).

Locus A. Perhaps the single most impressive and important prehistoric feature at Gu Achi is the reservoir, designated Locus A. What remains of the reservoir is a low, semi-circular earthen embankment rising about 0.75 m above the surrounding terrain (Figs. 27-29). The embankment is composed of sands, silts, and gravels obtained from the original prehistoric excavation of the reservoir and from subsequent dredging activities. Prehistoric artifactual material liberally covered the entire embankment, but few cultural materials were found on the alluvial silts inside and outside the embankment.

The present width of the embankment varies between 16 and 18 m, but deflation has most likely expanded the width beyond the original prehistoric measurements. The inside diameter of the reservoir is 30 m, thus spanning an area of roughly 900 sq. m or 0.22 acre-feet. The reservoir tested by Raab at AA:5:43 in the Santa Rosa Valley had a small detached embankment next to the reservoir opening that served to partition the "inlet canal" from the "overflow channel" (Raab 1975: Fig. 7). The reservoir at Gu Achi did not have such a specialized embankment; however, it is possible that a circular sherd and lithic scatter in a position analagous to that of the detached embankment at AA:5:43 may, in fact, represent the deflation of such an embankment (Figs. 27, 30).

The aerial photograph of Gu Achi (Fig. 19) shows that the reservoir banks were open to the west, the ideal position to receive water flow from either Gu Achi or Anegam Wash and possibly sheet wash from the terrace top. A small swale (Fig. 31) in the southern portion of the reservoir presently contains surface water at least a few weeks of the year, attesting to the suitability of the reservoir's location. An erosional channel has cut through the eastern portion of the embankment; otherwise the reservoir might hold an even greater volume of water.

The mechanism by which floodwater was controlled and brought to the reservoir is not known, but analogy with the reservoir at AA:5:43 and with historic Papago farming methods suggests at least two alternatives. First, as with the reservoir excavated at AA:5:43, it is possible that a canal tapping either Gu Achi or Anegam Wash flowed to the reservoir. There is, in fact, a faint line of cleared vegetation, paralleling the two washes for several hundred meters that seems to trend in the general direction of the reservoir (Figs. 19, 20). Surface inspection of this feature (Locus FF) revealed that it is not a recent historic road, but it is still unclear whether or not it represents a prehistoric canal or an old historic road. The linearity of this feature almost certainly precludes formation due to natural processes.

The second mechanism by which water may have been channeled to the reservoir is through the use of brush "borders" or "fences" on the terrace top. Castetter and Bell (1942: 168-169) note that small earthen dikes and brush fences were used by the Papago to control and divert floodwater. The floodwaters of Gu Achi and Anegam Washes may have been too violent for dependable management, making it necessary to focus attention on controlling the surface runoff from the terrace top. A series of dikes and fences may have been utilized to fill the reservoir.

A considerable amount of prehistoric trash lies on the reservoir embankment, similar to the situation noted by Raab at AA:5:43 (1975: 296). Emil W. Haury, upon inspection of the reservoir at Gu Achi, expressed the belief that the large quantity of trash suggests that habitation structures were likely to be adjacent to the reservoir and that the embankments were used for depositing trash (1978: personal communication). The amount and diversity of artifactual material, including burned animal bones, support this supposition. Because the northern portion of the reservoir embankment is approximately 20-30 cm higher than the rest of the embankment, it is possible that habitation structures, if present, were concentrated on the northern side of the reservoir. However, it is puzzling that trash was dumped next to what

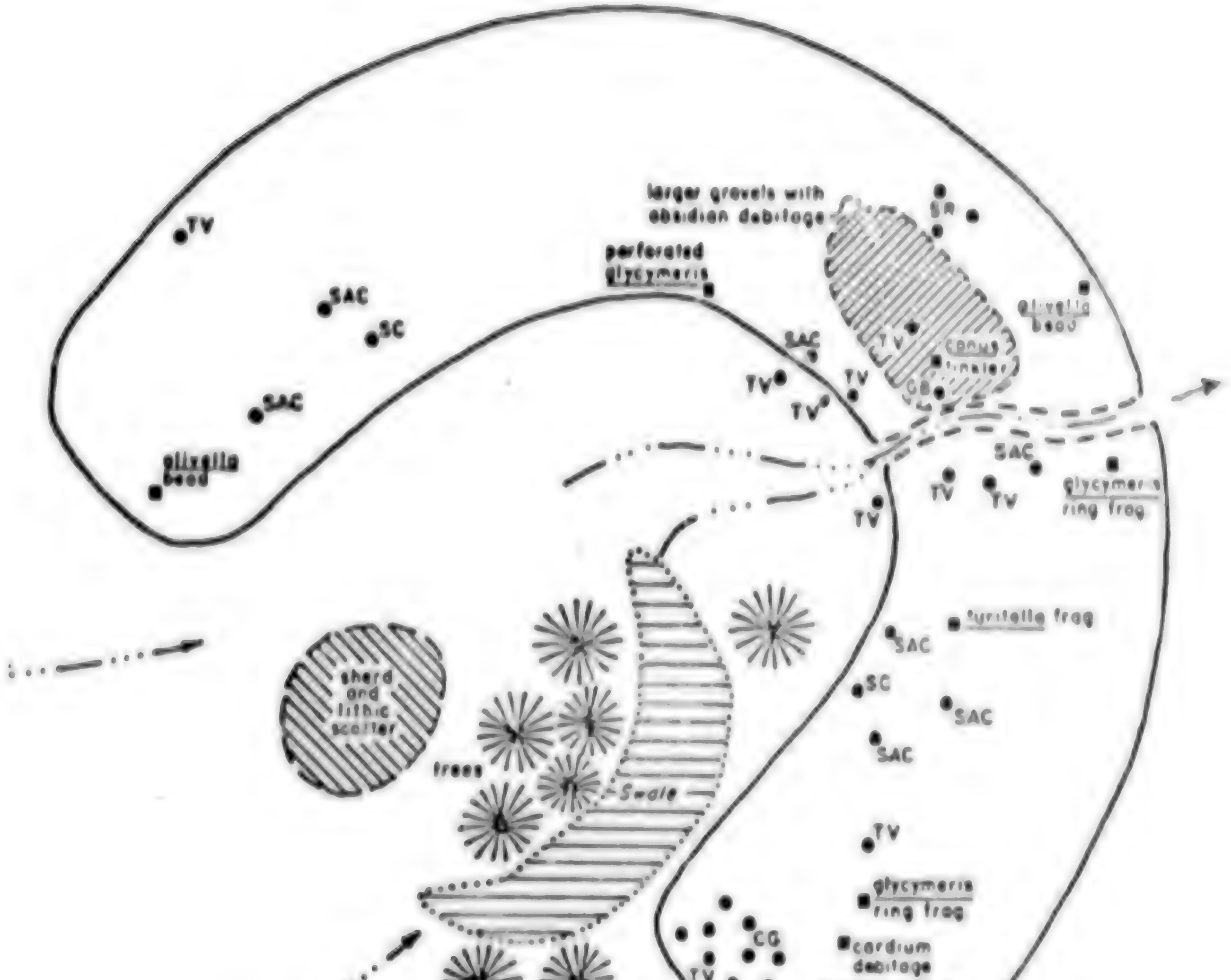

Figure 27. Map of the reservoir, Locus A.

must have been the major source of domestic drinking water. Ostensibly, because of its daily importance to the Gu Achi inhabitants, the reservoir may have served as a focal point for certain social and economic activities. For example, shell working, chipped stone tool manufacture, and basket weaving may have been done on the reservoir embankment. Thus, much of the artifactual residue may be the result of in situ activities rather than of trash dumping. Present surface evidence does not unequivocally support either of these alternatives.

The artifacts on the reservoir embankments included thousands of sherds, mostly plainware but also the following decorated types in decreasing order of frequency: Sacaton Red-on-buff (10), Tanque Verde Red-on-brown (8, not including several sherds to a single vessel), Santa Cruz Red-on-buff (2), Casa Grande Red-on-buff (several sherds to a single vessel), Sells Red (several sherds to a single vessel), and a single sherd of Gila Butte Red-on-buff. The spatial distribution of these decorated types is indicated in Figure 27. Scores of undecorated buffware and unidentifiable red-on-buff sherds were also noted. Schist-tempered plainware and Gila Plain were abundant. Smaller numbers of sand-tempered plainware were present.

Chipped stone debitage of green quartzite was common on the embankment; chert and obsidian flakes occurred less commonly. An area approximately 10 m in diameter on the northeastern portion of the embankment contained a much higher concentration of obsidian flakes than anywhere else at Gu Achi (Fig. 27). Most likely this was a chipping station where several obsidian tools were at least partially manufactured. More than a dozen hammerstones and scores of tabular schist tools were scattered over the embankment area. Few other types of chipped stone tools were present. Four unifacially retouched flakes were noted during the course of the survey, two each of obsidian and green quartzite. A fragment of a chalcedony projectile point was also found (Fig. 69n).

No ground stone was found on the reservoir embankment, unlike the situation noted for the reservoir at AA:5:43 (Strawn 1976). The reservoir at Gu Achi should have been an ideal location for bringing people together for food processing and social interaction, especially if habitation structures were adjacent. What the absence of ground stone may mean is unclear. The

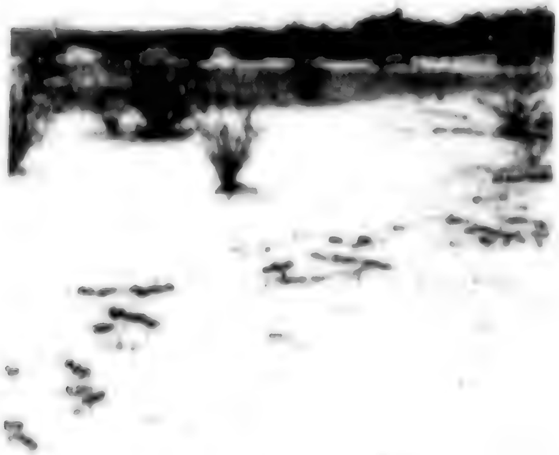

Fig. 28. View of the northern bank of the reservoir, Locus A, looking southeast.

Fig. 29. View of the southern bank of the reservoir, Locus A, looking northeast.

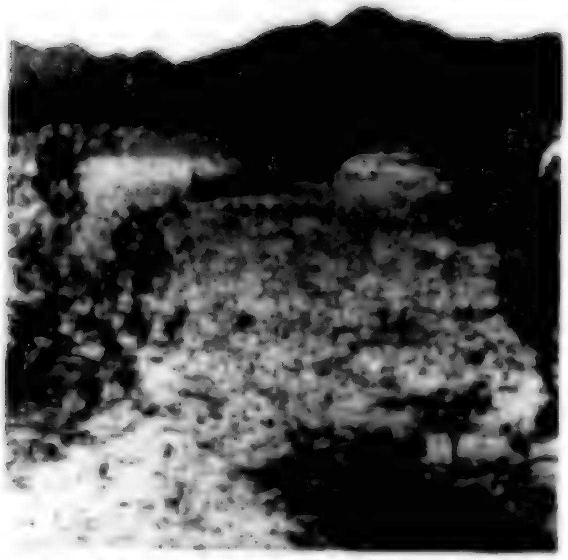

Fig. 30. View of possible deflated mound area on the western side of the reservoir, Locus A, looking northeast.

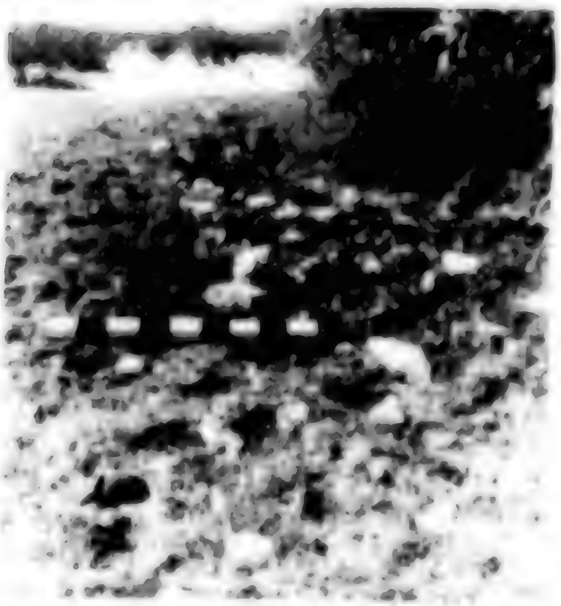

Fig. 31. Swale area inside reservoir banks, Locus A, looking southwest. Note the concentration of large stones.

only ground stone at Locus A was noted in the swale area. Here, several lightly worn slab metates, one partial basin metate, and many large unmodified cobbles were exposed (Fig. 31). These stones were at almost the same level as the terrain surrounding the reservoir, which suggests that they are at least 2-3 m above the bottom of the reservoir. Thus, these objects must have been deposited at a time when a large amount of silt, which was not subsequently cleaned out by maintenance activities, had already accumulated in the reservoir. It is probable that this took place no earlier than the Sells phase and possibly even as late as some time during the historic period.

Marine shell was abundantly scattered over the reservoir embankment. *Glycymeris* and cardium debitage was common, as were several whole and partial pieces of finished shell jewelry. Several *Olivella* beads, an unusual bracelet of *Trachycardium* (Fig. 108a), *Glycymeris* rings, and a worked *Turitella* shell (Fig. 105e) were among the specimens noted. The scarcity of freshwater shell on the reservoir embankment is somewhat puzzling. A standing body of water like the reservoir should have provided an excellent habitat. Almost certainly the heavy load of silts brought in by the channeled floodwaters had to be periodically cleared from the reservoir. The dredging of silts during reservoir maintenance should have deposited large numbers of freshwater shell on the embankment.

Large numbers of ceramics from both time periods show that the reservoir was used during the pre-Classic and the Classic. Present evidence suggests that the initial construction occurred some time during the transition between the Santa Cruz and Sacaton phases when the occupation at Gu Achi was largest. The reservoir tested by Raab (1975) at AA:5:43 similarly dates to this period. Although Raab suggests a date of circa A.D. 1000 for the reservoir at AA:5:43, for reasons to be discussed later, a date of A.D. 900 seems more reasonable for the initial construction of both reservoirs. A large amount of Sells phase trash indicates that Classic period populations also used the reservoir occasionally as a source of domestic water (for their seasonal agriculture camps?), but it is doubtful that they ever maintained the reservoir to any significant extent.

Locus G. Locus G is the only certainly identified trash mound at Gu Achi. It is rather unpretentious, rising less than 40 cm above the surrounding terrain and measuring approximately 15 m along the north/south axis and 18 m along the east/west axis (Figs. 32, 35).

Substantial trash mounds, such as Locus G, are always indicative of the presence of pit houses at pre-Classic period Hohokam villages. It is somewhat puzzling that there were few natural gravels interspersed with the alluvial silts and dense cultural deposits of the trash mound. Most loci near the trash mound had large quantities of gravels intermixed with the cultural deposits. Also, gravel deposits would have been encountered during the aboriginal excavation of the pit houses associated with the trash mound. What the scarcity of gravels in the trash mound may mean in terms of presence or absence of pit houses cannot be determined without testing.

The ceramics on the surface of the trash mound were all of the Santa Cruz and Sacaton phases. Several sherds of Santa Cruz Red-on-buff (Fig. 57a, b) and Sacaton Red-on-buff were noted, as were many unidentifiable eroded buffware sherds. Single sherds of two intrusive wares, Deadman's Black-on-red (Fig. 65i) and Black Mesa Black-on-white (Fig. 65j), were also present. Deadman's Black-on-red has been tree-ring dated from A.D. 750-1050 (Colton 1956) and Black Mesa Black-on-white, from A.D. 875-1130 (Breternitz 1966: 70); both dates support the Santa Cruz/Sacaton phase association.

A random collection of plainware rim sherds from the trash mound was made for comparison with those recovered during the course of the excavations. This collection indicated that jars outnumbered bowls more than 2 to 1 and that schist-tempered and sand-tempered vessels were both present in large numbers. Only a single rim sherd of Gila Plain was encountered. *Glycymeris* bracelet fragments and debitage from *Glycymeris*, cardium, and pecten shells were common on the trash mound. No chipped stone tools were observed, but many flakes of chert and, especially, green quartzite were present. A few unidentified animal bone fragments were seen in the dirt surrounding rodent burrows. These fragments were neither burned nor worked and appear to represent small mammals and possibly medium-sized artiodactyls.

Ground stone was conspicuously absent from Locus G. Although some vesicular basalt was seen, most was burned or fire-cracked and had no worked surfaces. It is strange that much of the ground stone noted during the course of the survey was confined to the erosion channels of Locus H and the Sells

Fig. 32. John Clonts standing on the trash mound, Locus G. View is to the northeast.

Fig. 33. Close-up of the top of the trash mound, Locus G, looking northwest.

phase processing camp loci. For some reason the Santa Cruz/Sacaton phase loci had little surface ground stone. However, excavation in Santa Cruz/Sacaton phase areas, such as Excavation Areas 1, 2, and 5, revealed several pieces of ground stone. Possibly either Sells phase people or the protohistoric and historic Papago gathered the pre-Classic period ground stone for their own needs.

Locus FF. Because a canal was joined to the reservoir tested by Raab (1975) at AA:5:45, it was hoped that traces of a similar canal would be encountered at Gu Achi. Inspection of the aerial photograph of Gu Achi (Fig. 19) revealed a faint line, seemingly free from vegetation, that was situated between Locus AA and Locus GG and extended for more than 400 m in the direction of the reservoir. On-the-ground inspection of this feature, designated Locus FF, proved somewhat disappointing and inconclusive. Locus FF was indeed a linear strip, 4-5 m wide, that was generally free from vegetation. Unfortunately, there was no evidence of banks, and few artifacts were located around Locus FF. The soil inside and outside the feature was a sterile, tan, sandy silt. An attempt was made to clean the banks of a small erosion channel northeast of Locus GG in the hope that the channel of the presumed canal would be outlined in cross section. This was unproductive, but the lack of results does not prove that Locus FF is not a canal. The channel was not very deep (approximately 1 m), and the actual path of Locus FF could not be accurately traced as far west as the channel. Thus, the deposits of the hypothetical canal could be deeper than the erosion channel exposure; or the canal may have crossed the erosional channel in a different location than was cleaned. Possibly Locus FF is an historic road, but it does not have features, such as obvious wheel ruts, noted for other historic roads encountered in the survey area. Further, the presence of several large creosote bushes and one sizeable mesquite tree in the middle of Locus FF indicate that if it is, in fact, a road, it has not been in use for several decades. The proper identification of this feature must await future testing.

Locus CC. A few hundred meters west of Locus U was an area that had undergone extensive deflation. Throughout the approximately 5000 sq. m of this area, Locus CC, many deflated concentrations of pre-Classic period cultural materials were clearly visible (Fig. 34). These concentrations were visible nearly everywhere that erosion had removed at least 15 cm of soil. In some cases the cultural concentrations appeared to be meaningless jumbles massed below the original occupation levels, but in several locations the cultural material seemed to be still in situ.

The most important features observed in Locus CC were two subrectangular depressions in the northwestern portion of the locus. One of these (Fig. 35) measured approximately 8 x 3 m with the long axis oriented northwest/southeast; the other depression measured 6 x 4 m with the long axis oriented in the same direction. While natural origin cannot be ruled out entirely, it is probable that these two depressions are the remnants of Hohokam pit houses. In order to test this hypothesis, three small pits were placed in the presumed house structure depicted in Figure 35, one in the western corner and one each along the center of the southwestern and northeastern walls. Unfortunately, no cultural manifestations, such as a prepared floor, signs of burning, or artifacts, were noted in the sterile silty soil of the test pits. It is possible that most if not all of the original floor was destroyed by erosion. Until more work is done, the nature of these

Fig. 34. General view of heavily eroded cultural deposits of Locus [illegible], looking northwest. The Black Hills are in the background.

Fig. 35. Eroded pit house(?) in western portion of Locus CC, looking southeast

two depressions will remain problematic. Nevertheless, it is highly likely that future testing will not only prove these depressions to be pit houses but will also reveal other house structures in the surrounding area.

The cultural materials of Locus CC were typical of pre-Classic loci: large amounts of ceramics, fire-cracked stone, shell, and various chipped stone items. No ground stone was observed. The red-on-buff ceramics scattered throughout the locus were from the Gila Butte and early Santa Cruz phases. If the depressions discussed above are, in fact, pit houses, then it is likely that Gu Achi was a sedentary village at least as early as A.D. 700.

Locus Q. Locus Q was a small Santa Cruz/Sacaton phase enclave situated along the north-central portion of Locus D. It lies on top of a gravel terrace which parallels Gu Achi Wash, about 1 to 2 m above the creosote plain immediately to the north.

In Locus Q the density of the cultural deposits was considerable. The entire 250 sq. m was carpeted with a wide variety of artifacts. The densest concentration of materials lay on the north-facing slopes of the terrace (Figs. 36, 37), giving them an appearance similar to that of the trash mound deposits of Locus G (Fig. 33). However, the physical situation of Locus Q belied the possibility of it ever having been a trash mound.

Many sherds of Sacaton Red-on-buff and Santa Cruz Red-on-buff were noted, including a scoop fragment of the latter type. Decorated wares from earlier or later time periods were not present. A chipped and partially ground sherd disc was collected from Locus Q. This specimen (Fig. 64o), probably of late Santa Cruz phase age, has a red design on a buff-colored slip. The temper is sandier than is normal for Gila Basin buffwares, and the ware may be locally made. Schist-tempered plainwares were dominant. Green quartzite flakes and pieces of tabular schist were abundant. Also seen were several unifacially retouched flakes of green quartzite with steep edge angles that suggest a scraping function. A chalcedony projectile point (Fig. 69h) typical of the Santa Cruz/Sacaton time period and a cardium shell that had been worked into the shape of a disc (Fig. 105i) were collected several meters north of the foot of the terrace. In general, shell was plentiful, including *Glycymeris* bracelet fragments and *Glycymeris*, cardium, and pecten debitage. Several fragments of both burned and unburned non-human bone were observed around rodent holes. Several chunks of charcoal were also noted near the rodent holes. One of the most surprising finds at Locus Q was several large pieces of ground stone, representing at least two trough metates, one basin metate, and a fragment of a shaped rectangular bifacial mano. In light of the unusual lack of ground stone at most other Santa Cruz/Sacaton phase loci at Gu Achi, it was of interest to find it well represented at Locus Q.

Locus R. Approximately 100 m west of Locus Q a heavily dissected and actively eroding area exhibited a dense scattering of cultural debris. This area, designated Locus R, covered almost 850 sq. m. Erosion has modified or destroyed up to 20 percent of the locus; however, this erosion exposed a substantial occupation surface at a depth of 35-40 cm. This surface consisted of a compacted layer of chunky clay upon which large sherds, chipped stone, fire-cracked pieces of vesicular basalt, and chunks of charcoal were liberally distributed (Fig. 38). In many respects this surface resembled the occupation surfaces encountered in Excavation Area 1.

The material culture at Locus R was typical of that already described for other Santa Cruz/Sacaton phase loci at Gu Achi. Sherds of Santa Cruz Red-on-buff and Sacaton Red-on-buff (Fig. 59a, f) were numerous. Also present were a sherd of Gila Butte Red-on-buff and an intrusive sherd of late Rillito Red-on-brown (Fig. 63e). Three sherds of Rincon Red were also found in Locus R. Plainwares were nearly all schist-tempered. Only a few sand-tempered sherds were present.

As at Locus Q, numerous specimens of both chipped and ground stone were noted. While no chipped stone tools were observed, debitage of a wide range of material, including green quartzite, jasper, and obsidian, was abundant. Fragments of at least one trough metate and of several shaped, rectangular bifacial manos were encountered. Some fragmentary calcined human bones a few meters west of Locus R suggest that a cremation was once present.

Loci DD, EE, and OO. Locus DD was a rich area of pre-Classic cultural deposits that encompassed approximately 3400 sq. m. A deep erosional channel had cut through a portion of the locus and exposed a cross section of the deposits.

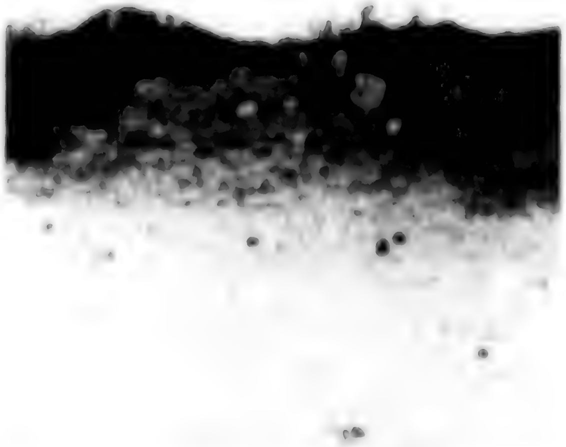

Fig. 36. Locus Q, showing cultural materials deposited on a slight natural rise, looking south.

Fig. 37. Close-up of the heavy concentration of cultural materials at Locus Q, looking south.

Fig. 38. Locus P in foreground, looking east.

Fig. 39. View of Locus R (center of photograph), looking east.

A well-defined gray cultural layer was observed at an average maximum depth of 45 cm below the present ground surface. This layer ranged from 10 to 15 cm in thickness and contained numerous artifacts. Above this layer cultural material was only infrequently noted in the arroyo bank. However, artifact numbers increased greatly a few centimeters below the present ground surface and covered the surface with dense concentrations. Even though the surface deposits did not form a mound, the nature of the deposits suggests that the surface material may have resulted from the deflation of one or more trash mounds, with the actual prehistoric living surface being the cultural layer noted above. Support of this hypothesis is provided, in that both the deep cultural layer and the surface materials can be temporally assigned to the Santa Cruz phase. These two cultural units may, therefore, be contemporaneous.

Nearly all of the decorated pottery was Santa Cruz Red-on-buff, the majority stylistically early in the phase. One bowl rim was decorated with rows of an unidentified mammal, perhaps coyote, deer, or even domestic dog (Fig. 57g). A few sherds of early Sacaton Red-on-buff indicate that occupation may have lasted until the beginning of the Sacaton phase. Plainware pottery was dominated by schist-tempered and sand-tempered types. Substantial numbers of Gila Plain sherds were also noted. The chipped stone assemblage consisted of large numbers of flakes of green quartzite and occasional flakes of basalt and obsidian. Pieces of tabular schist and fragments of burned vesicular basalt were abundant. Ground stone was absent, with the exception of an interesting miniature rubbing stone of green quartzite (Fig. 84a). Many specimens of shell were observed, including Glycymeris bracelet fragments and manufacturing debris, cardium and pecten debitage, and a fragment of a whole valve pecten pendant.

Animal bone, both burned and unburned, was present in considerable quantities, including bones of rabbit (species unknown) and medium-sized artiodactyl (probably deer and sheep). Isolated cremated human bones were noticed in a few locations on the surface, and a small mass of bones that almost certainly was the remnants of a cremation was found in a deflated area next to the erosional channel. No clearly associated offerings were found with the cremation.

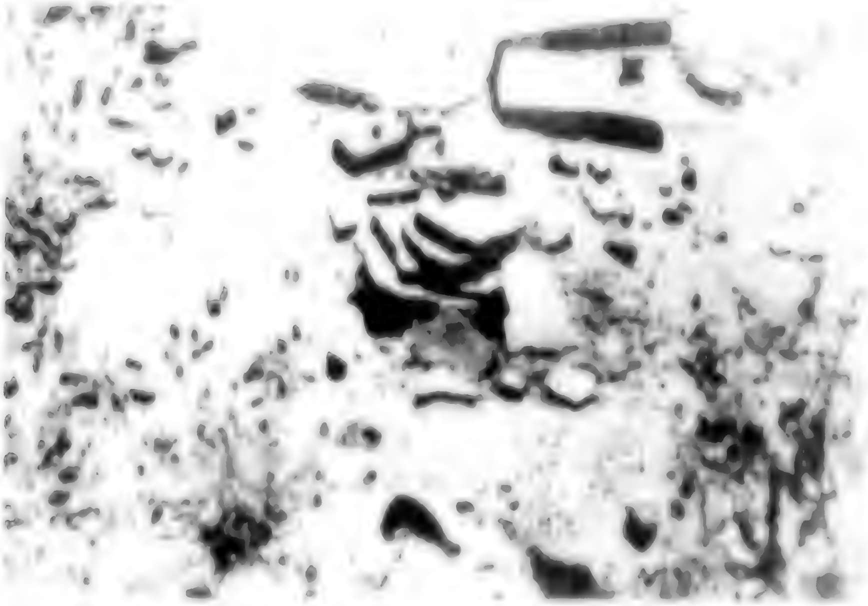

Fig. 40. Sherd stack and shell débitage in deflated portion of Locus OO.

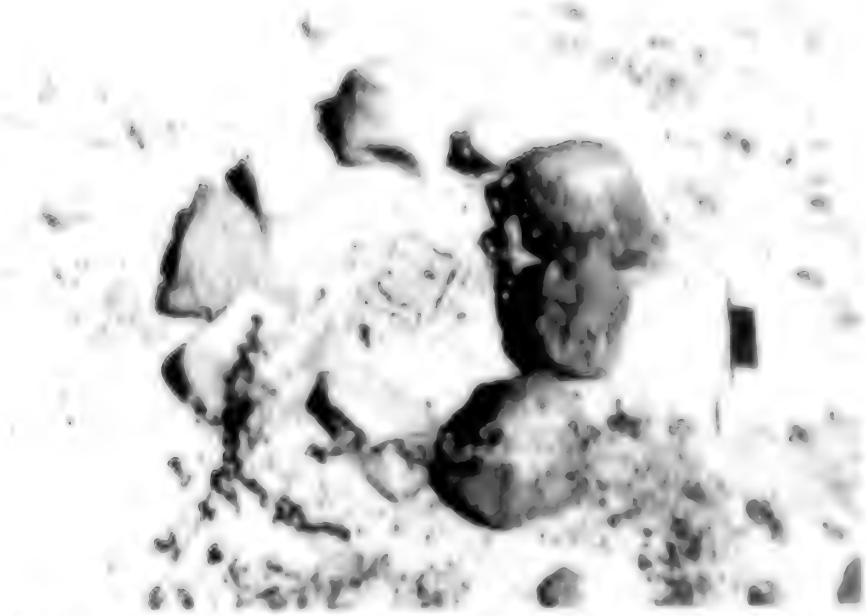

Fig. 41. Stone ring in deflated area southeast of Locus OO.

Less than 50 m north of Locus DD was the beginning of another surface cultural deposit that covered nearly 4000 sq. m. Most of this area (Locus EE) exhibited only a light to moderately dense concentration of cultural materials though several areas 5-10 m square had very dense concentrations of materials. As no erosional channels cut through this locus, depth of the cultural deposits could not be ascertained.

The cultural assemblage at Locus EE was quite similar to that of Locus DD but included a few sherds of Gila Butte Red-on-buff that suggest a slightly earlier occupation. Shell, burned vesicular basalt chunks, and chipped stone pieces were abundant. A few flakes of rhyolite, chalcedony, and white quartzite were observed in addition to the material types noted for Locus DD.

Locus FF was an area of approximately 35,000 sq. m west of Locus CC and southwest of Locus DD. A light to moderate pre-Classic period sherd scatter covered most of the area, though several heavy concentrations of cultural material covered more than 5000 sq. m. The physical situation of this locus was much the same as Locus F; the southern portion of Locus FF was heavily dissected and deflated by erosional channels flowing into Gu Achi Wash while the northern portion was relatively undisturbed. The walls of several erosional channels clearly showed a gray-colored occupation layer with a maximum depth of 40 cm, similar to the situation noted for Locus DD. In some areas deflation had exposed the top of the occupational layer while in other areas it had destroyed the entire occupational layer and left only a jumbled mass of redeposited artifacts.

All the numerous decorated ceramics found throughout Locus FF were Santa Cruz Red-on-buff. The majority were stylistically late in the phase. Among the designs noted on these sherds were the "flying bird" motif (Haury 1976: 243-245) and a human form carrying a burden basket. Plainware sherds of sand-tempered, schist-tempered, and Gila Plain all were abundant. A curious small stack of sherds from three different plainware vessels was seen on a deflated occupational surface in the eastern portion of the site (Fig. 40). A small trowel test pit placed next to the sherd stack revealed a layer of charcoal, ash, and burned animal bone immediately below the present ground surface. This suggested that the sherd stack was in situ and not the result of chance redeposition. Similar sherd stacks have been noted at

Hohokam sites in the San Pedro Valley (Masse in press c) and in the Tucson Basin (Linda Gregonis 1978: personal communication), but their function is still unclear.

Green quartzite dominated the chipped stone assemblage. Numerous flakes, cores, hammerstones, and core tools of this material were present. Other material types included chalcedony, chert, and jasper. Tabular schist was frequently encountered, several pieces of which were "knives" with ground margins. In spite of the large area covered by Locus OO, only a few items of ground stone were observed, including a vesicular basalt trough metate, a basin metate of green schistose material, and a shaped rectangular bifacial mano of vesicular basalt. Although worked shell was scarce, unworked fragments of *Glycymeris*, pecten, and cardium were abundantly scattered throughout the locus. An unground *Glycymeris* band, probably accidentally broken when its core was removed, can be seen in the foreground of Figure 40. The only piece of worked shell was a *Glycymeris* shell ring fragment, apparently broken in manufacture. Burned animal bone was common, including portions of several rabbits and medium-sized artiodactyls (probably sheep or deer). One artiodactyl long-bone fragment had been fashioned into a well-polished awl.

Burned chunks of vesicular basalt were copiously scattered throughout Locus OO, often occurring in tight clusters, no doubt the product of deflating hearths. One curious ring of vesicular basalt, approximately 0.5 m in diameter, was located 30 m east of the locus in an area that has undergone considerable deflation (Fig. 41). There was no charcoal or trash in or around this feature to suggest its use as a modern hearth, and it could date anywhere in historic or prehistoric times. Goodyear (1975: 109-118) and Raab (1973a) have noted similar features in their survey of the Slate Mountains and have interpreted their function as a rest for baskets or ceramic containers during wild plant gathering activities. Another, slightly larger, stone ring was noted at Gu Achi in an agricultural area east of Locus 5.

Loci O and NN. Locus O was a deflated hearth with an associated small sherd and lithic scatter south of Locus N. The hearth consisted of vesicular basalt chunks and a few pieces of tabular schist spread over a 2 sq. m area. Sherds immediately associated with this hearth were all sand-tempered plainwares. The sherd and lithic scatter, which lay about 3 m south of the hearth, contained several eroded buffware sherds, many sherds of schist-tempered plainware, and a few sherds of Gila Plain. Green quartzite flakes were the only other noteworthy artifacts.

Generally this locus seemed to be a processing camp. The buffware sherds suggest that Locus O may date to the pre-Classic period; however, it is possible that the hearth may not be associated with the sherd and lithic scatter and may instead be of Sells phase age.

Locus NN was a small, moderately dense concentration of pre-Classic period trash approximately 100 meters east of Locus MM. This locus was the most distant from Gu Achi Wash (and the closest to Anegam Wash) of any of the pre-Classic period loci. Decorated ceramics were solely from early Sacaton Red-on-buff bowls and jars. Sand-tempered sherds dominated the plainwares, but sherds of schist-tempered plainware were also common. Flakes of green quartzite and basalt were numerous, and a limestone chopper was present. A tabular schist "knife" with a ground margin was also noted. Ground stone included a trough metate fragment and a shaped rectangular unifacial mano, both of vesicular basalt. One fragment of cardium and a few pieces of *Glycymeris* debitage completed the artifact inventory.

In many respects Locus NN resembled the Sells phase processing camps described in the next section. The small size of Locus NN, its isolation from the major pre-Classic occupation areas of Gu Achi, and the presence of ground stone, tabular schist knives, and a chopper are all features common to Sells phase loci at Gu Achi. However, the possibility that Locus NN was an isolated habitation structure cannot be ruled out.

Miscellaneous Pre-Classic Period Loci. In addition to the loci already discussed, twenty-four other loci date to the Gila Butte/Sacaton phase occupation at Gu Achi (see Table 5). These generally consist of light to moderately dense scatters of artifacts with occasional areas of heavy concentration. Fire-cracked chunks of vesicular basalt are commonly scattered throughout these loci, as are tabular tools of schist and flakes and tools of green quartzite. Ceramics constitute the bulk of the artifacts in each locus, with schist-tempered plainware abundant, sand-tempered plainware common, and specimens of Gila Plain usually rare. Numerous shell artifacts were also found in these loci, especially the debris from shell bracelet manufacture. Loci F and II had examples of Glycymeris cores fashioned by the "grinding-faceted" technique (see Appendix E, Fig. 109e), while Locus U contained two specimens of grinding-faceted debitage. Burned animal bone (rabbits, deer, and sheep) was seen in nearly every locus and projectile points were not uncommon. Somewhat surprisingly, ground stone was generally lacking at most of these loci.

At least two loci, Loci B (Fig. 39) and I, contain heavy concentrations of cultural material that may be the remnants of trash mounds. At both loci circular areas of artifacts were elevated 5-10 cm above the surrounding terrain. Locus QQ had two elevated areas of trash deposits (10-15 cm above the surrounding terrain), but the material was less concentrated than might be expected for trash mounds. Erosional channels in Locus QQ did reveal, however, a possible occupational surface at a depth of about 40 cm below the modern ground surface.

Sells Phase Loci

Seven loci at Gu Achi could be assigned to the Classic period Sells phase occupation. These are small sherd and lithic scatters, ranging in size from 50 sq. m to 2300 sq. m. Hearths formed with chunks of vesicular basalt are present in each locus, and ground stone and tools of tabular schist are frequent associations. Locus L consists solely of five small deflated hearths and a few associated tabular schist tools. Locus L was assigned to the Sells phase because of the nature and physical situation of the hearths. A detailed description of four of the Sells phase loci will now be presented.

Locus H. Locus H is approximately 30 m east of the trash mound. This small area, about 10 sq. m, consisted of a scattering of burned chunks of vesicular basalt and several large pieces of tabular schist. Large numbers of sherds were found at Locus H, but chipped stone, ground stone, shell, and other types of artifacts were absent. The pottery was mostly sand-tempered plainware; schist-tempered plainware and Gila Plain were absent. A few sherds of Sells Red and a Tanque Verde Red-on-brown jar indicate that the feature dates to the Sells phase. Also present were a few sherds from a thin-walled jar with a small amount of mica in the temper; this jar appeared to be a variant of Gila Red.

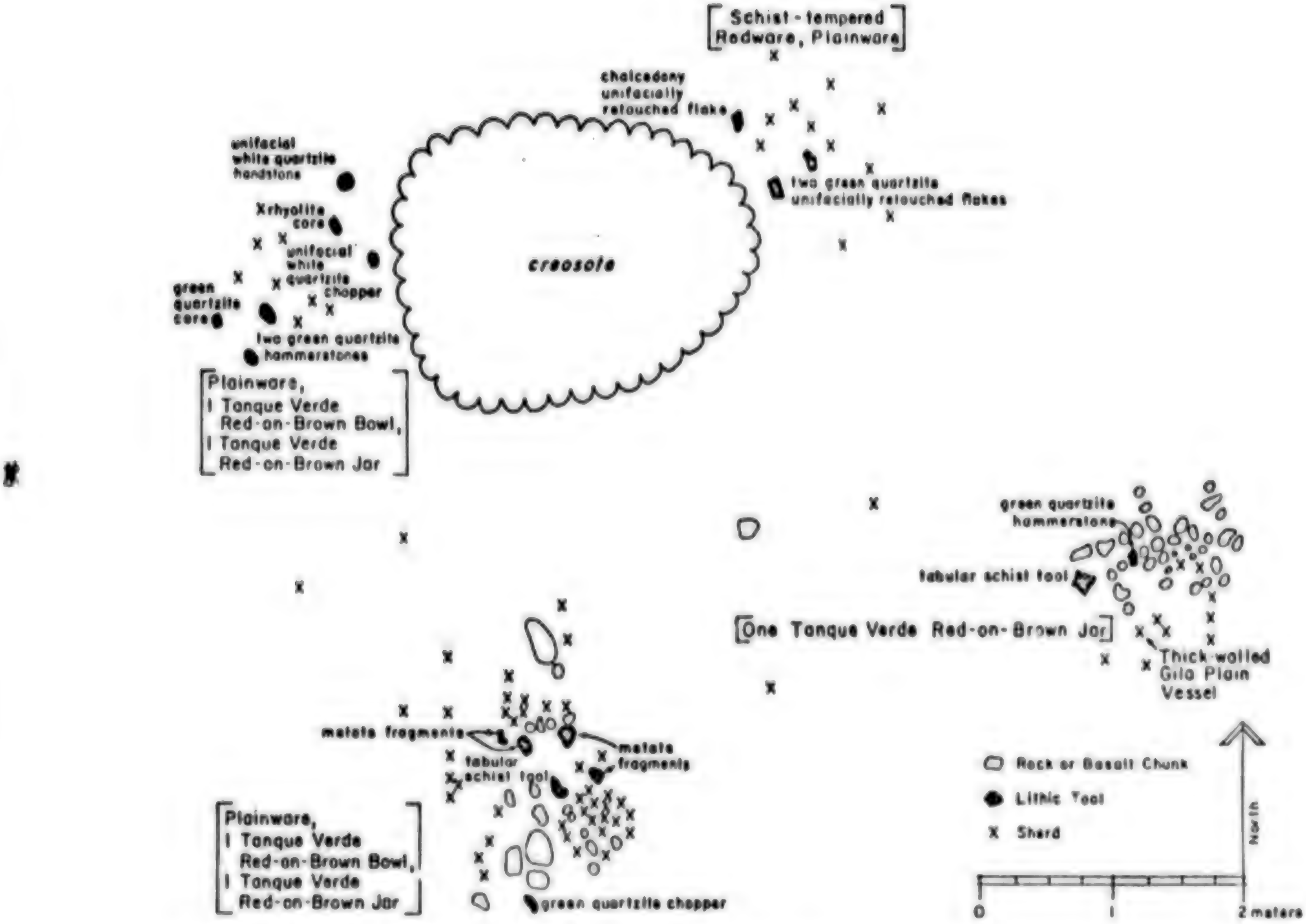
Schist-tempered Redware, Plainware
chalcedony unifacially retouched flake
two green quartzite unifacially retouched flakes
unifacial white quartzite handstone
rhyolite core
unifacial white quartzite chopper
green quartzite core
two green quartzite hammerstones
creosote
Plainware, 1 Tanque Verde Red-on-Brown Bowl, 1 Tanque Verde Red-on-Brown Jar
green quartzite hammerstone
tabular schist tool
One Tanque Verde Red-on-Brown Jar
Thick-walled Gila Plain Vessel
metate fragments
metate fragments
tabular schist tool
Plainware, 1 Tanque Verde Red-on-Brown Bowl, 1 Tanque Verde Red-on-Brown Jar
green quartzite chopper
Rock or Basalt Chunk
Lithic Tool
Sherd
North
0
1
2 meters

Figure 42. Map of Locus Y, Sells phase processing camp.

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Fig. 14. Locus 1's [illegible] [illegible] [illegible] [illegible] '[illegible]' hearths.

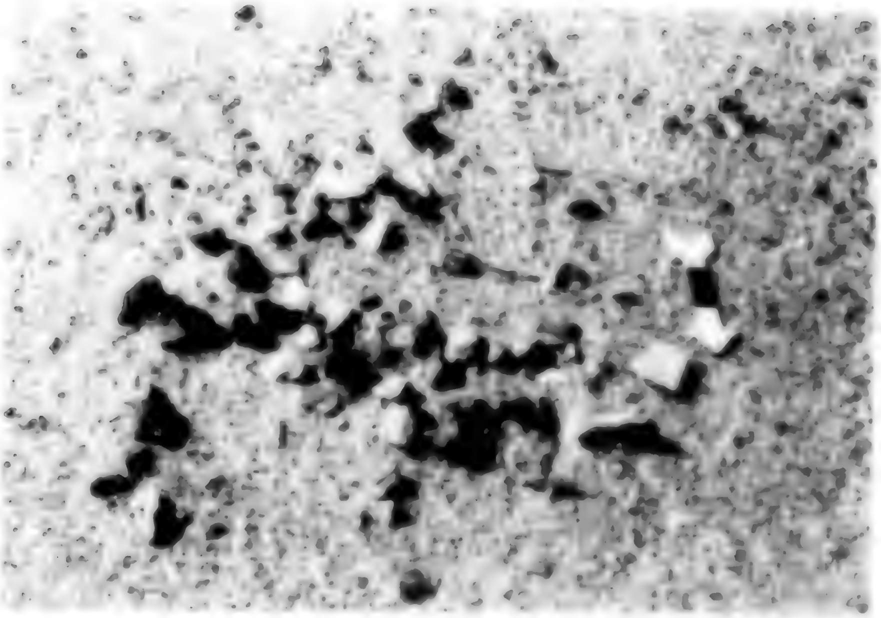

Fig. 15. Close-up of western hearth in Locus 1. Many sherds, burned vesicular basalt 'manos' and fragments of tabular schist.

There is little doubt that Locus U is a deflated hearth with associated activity area. Several similar features were encountered during the course of the survey, all of which had chunks of vesicular basalt, tabular schist, and some sherds in association. These most likely represent "processing camps" associated with nearby floodwater agricultural fields; this point will be elaborated on later in the discussion of subsistence activities at Gu Achi (Chapter 5). Locus U was unique, however, in that, in contrast to other processing camps at the site, it was carpeted with tiny sherds. Nearly all of these sherds ranged in diameter from 1 to 2 cm. Apparently the sherds at Locus U have been subject to more intensive mechanical breakdown processes (such as trampling by humans or animals) than the other loci. Unfortunately, the reasons for this phenomenon are unknown.

Locus Y. Locus Y consisted of two small deflated hearths (Figs. 42-44) and associated artifact concentrations. Because this locus was so typical of the "processing camps" at Gu Achi, a detailed field examination was made of the surface material and a sketch map, presented as Figure 42, was drawn.

The most notable features were the hearths, marked by fire-cracked stones scattered over an area of 1-2 sq. m. Vesicular basalt was almost the only material type used in Sells phase "processing hearths," with the exception of some pieces of tabular schist. River cobbles, which can be obtained easily from Gu Achi and Anegam Washes at present, were rarely found in these hearths. A possible explanation for this is that arroyo-cutting may have only recently exposed the strata containing these cobbles and they may not have been available to the prehistoric occupants of Gu Achi in any quantity.

Tabular schist almost invariably occurs around the hearths in Sells phase processing camps. Because tabular schist is friable and easily fractured, it is often difficult to determine if a specimen has been naturally broken or purposefully worked. In the case of Locus Y, both pieces of tabular schist appear to have been bifacially flaked. Neither specimen showed evidence of having been burned, a frequent feature noted for tabular schist in other processing camps at Gu Achi.

Sherds and lithic tools formed four distinct clusters that can be readily observed in Figure 42. Of interest is the large number of Tanque Verde Red-on-brown sherds (one of which is depicted in Fig. 60)) in relation to plainware and redware sherds. A total of five Tanque Verde Red-on-brown vessels--two bowls and three jars--was noted in three of the clusters. A schist-tempered redware jar, at least one jar of sand-tempered plainware, and one bowl of Gila Plain were also present. A single sherd from a censer of Gila Plain most likely came from nearby earlier Santa Cruz/Sacaton phase trash deposits. The high ratio of decorated vessels to plainware vessels is also typical in the Sells phase processing camps reported by Raab (1976: 193, 202-204) and Goodyear (1975: 95). An unperforated disc fashioned from a sherd of late Rillito or early Rincon Red-on-brown was found a few meters west of the western hearth (Fig. 64t). This disc either may be an accidental intrusive from earlier trash deposits nearby or may have been made and used by the Sells phase occupants of the processing camps.

Ground stone was present in two of the sherd and lithic concentrations. Several fragments of a vesicular basalt metate, unidentified as to type, were found near one hearth while a unifacial handstone of white quartzite was found 5 m north of this hearth. Chipped stone artifacts included three hammerstones, two choppers, three unifacially retouched flakes with edge angles greater than 55°, two cores, and a thin scattering of debitage that consisted primarily of flakes of green quartzite but included a few flakes of chert and jasper. Two fragments of a thin-banded *Glycymeris* bracelet and a piece of *Glycymeris* debitage completed the artifact inventory from Locus Y.

Locus LL. Due north of Locus KK was a scattering of Sells phase cultural material that covered an area of 2300 sq. m. This was the largest areal concentration of Sells phase material discovered at Gu Achi. Most of this area, Locus LL, had only a light to moderate surface trash scatter, but one heavy concentration of materials, about 5 m in diameter, was encountered in the western portion. This locus probably served as a major agricultural processing camp.

Several sherds of Tanque Verde Red-on-brown, from at least one jar and one large bowl, were noted. Other decorated ceramics included a jar sherd of Gila Polychrome, a sherd of Casa Grande Red-on-buff, and two unidentified buffwares. Sherds of Sells Red and an apparently locally made schist-tempered redware were also encountered. Sand-tempered specimens dominated the plainwares; sherds of a late variety of Gila Plain were also common. Chipped stone cores of several different material types were present, including green quartzite, limestone, rhyolite, and white quartzite. In addition, a unifacially retouched tool of chert with a steep edge angle, several chert flakes, and pieces of tabular schist--many of which appeared to be worked--were present.

Three metates were found in Locus LL, each separated 10-15 m from one another. These metates were of three different types--a slab metate of rhyolite, a vesicular basalt trough metate, and a vesicular basalt basin metate. This suggests that functionally specific, discrete work areas may have existed during the prehistoric occupation. Unfortunately, because few other cultural items were found in association, this hypothesis was untestable.

As was typical of other Sells phase loci at Gu Achi, in spite of the large size of Locus LL, only a small number of shell specimens were observed. A few pieces of Glycymeris and cardium debitage, a fragmentary univalve (Melongena patula), and a whole Olivella shell with the spire still intact were noted.

Locus MM. Locus MM, like Locus LL, appears to be a major Sells phase agricultural processing camp. It was smaller than Locus LL, covering approximately 1800 sq. m, but exhibited the same general pattern of features. The cultural material was scattered lightly over most of the area, but there was an extremely heavy concentration, 5 m wide and 15 m long, in the southern part of the locus. A possible prehistoric road cut through a section of the processing camp but appeared to have disturbed the cultural deposits little.

Sherds from at least three Tanque Verde Red-on-brown bowls and one jar were the only decorated pottery observed. The three bowl rims are decorated on both the interior and exterior with design elements more reminiscent of the Sedentary than of the Classic period. It is probable, but not certain, that these sherds are of the poorly understood early Classic period type Topawa Red-on-brown (Withers 1973). If they are Topawa Red-on-brown sherds, Locus MM may represent the first reoccupation of Gu Achi after the village was abandoned in the 11th century A.D. A few sherds of Sells Red, from different bowls, were also found at this locus. Plainware jars and bowls were numerous; sand-tempered, schist-tempered, and Gila Plain specimens were all common. One schist-with-sand-tempered sherd was from a large, thin-walled

(0.3-0.4 cm) jar that had been made by the "two-piece" method; the bottom portion was made in a mold (i.e., basket, bowl, or other similar receptacle), and the top was applied after the bottom had been completed. This type of pottery manufacture has been noted for the Classic period Hohokam (Haury 1945: Fig. 27d, e). A chipped, but not ground, plainware sherd disc was also found in Locus MM.

Green quartzite cores and flakes, a green quartzite chopper, and flakes of white quartzite and jasper comprised the chipped stone assemblage. Several manos and handstones and a single fragment of a vesicular basalt basin or trough metate were seen. Manos included two shaped rectangular unifacial specimens and one each of vesicular basalt and gneiss while handstones consisted of one bifacial vesicular basalt specimen and three unifacial specimens of marble, gneiss, and white quartzite, respectively.

As in Locus LL, shell was not abundant. Only four items were observed: a *Glycymeris* bracelet fragment, a piece of Cardium elatum, an unworked specimen of *Pteria sterna*, and a fragment of an unidentified bivalve. A few burned unidentified animal bones were also noted in Locus MM.

Miscellaneous Cultural Manifestations

The 44 loci discussed above were the major surface features found during the course of the survey at Gu Achi. Additional loci that were not recorded may be present. For example, the areas north of loci A, K, and LL were not surveyed as intensively as other areas; nor was the area between Locus A and the southern tip of the Sheridan Mountains. In these areas of less intensive survey, large sherd and lithic scatters (in excess of 1000 sq. m) would undoubtedly have been found, and it is certainly possible that at least a few smaller loci, such as Sells phase processing camps, could have been missed. Almost certainly, however, all features of any importance between Locus A to the east, Locus LL to the north, Locus OO to the west, and Gu Achi Wash to the south were noted during survey and recorded. Thus, for example, the absence of surface features around the hypothesized canal (Locus FF) is real and is not due to omissions during survey recording.

At least a few loci bordering FIR 34 no doubt originally extended into the area now covered by the road. It is also likely that some loci may have

Fig. 45. Hearth northeast of Locus 8, looking south.

Fig. 46. Hearth north of Gu Achi near Anegam Wash, looking north.

been totally obliterated by the original road construction and dike-building activities.

In addition to the 24 loci listed above, several minor features of interest were noted, including numerous isolated artifacts within the site boundaries. Many hearths were scattered throughout Gu Achi, averaging 1.5 m in diameter, and consisted of burned vesicular basalt chunks and large pieces of tabular schist. A few instances of sand-tempered plainware sherds, tabular knives, green quartzite flakes, a couple of unidentified buffware sherds, and one sherd of Tanque Verde Red-on-brown were the only other material culture in association with these features. Typical isolated hearths are shown in Figures 45 and 46. The location of five additional isolated hearths is shown in Figure 20. As a conservative estimate, at least 30 others were observed during survey but were not recorded. These hearths were found in all portions of the site but were most prevalent in the area bounded by the reservoir to the east, Locus 5 to the west, and Anegam Wash to the north. Another concentration was noted between Locus 6 and PIR 34 to the south.

Tabular knives made from thin spalls of schist were common throughout the entire site area of Gu Achi; a few specimens made from andesite or basalt were present. Approximately 25 specimens were noted, nine of which had been worked into a form commonly referred to by a variety of functional terms, including "mescal knife" (Greenleaf 1975a: 95), "hoe" (Haury 1945: 134-137), "grass knife" or "fleshing knife" (DiPeso 1956: 215-217, 409), and "saw" (Zahniser 1966: 156). These eleven specimens had been chipped into "hoe-like" shapes; their use margins were ground, usually honed to a fine polish. The other 14 tabular knives were roughly chipped into various quadrilateral shapes, with some specimens approaching a "mescal" knife shape, such as the specimen from Locus B (Fig. 75i). Several of these had polishing striations from use wear that clearly demonstrated their function as cutting tools. Scores of tabular schist chunks with possibly flaked margins were scattered throughout the boundaries of Gu Achi, and it is likely that many of these also served as knives.

The distribution of isolated tabular knives roughly coincides with the distribution of isolated hearths. In three cases, tabular knives were found within 5 m from hearths. The large numbers of hearths and tabular knives, coupled with the pattern of their distribution, argue convincingly for intensive in situ plant collecting and processing activities. As will be elaborated in Chapter 5, agricultural products were most likely the focus of this activity.

A few pieces of ground stone were found away from isolated hearths and other artifact concentrations. Large fragments of an isolated basin metate and an isolated slab metate were located east of Locus 5, and one-half of a portable mortar of vesicular basalt was found between the reservoir and Anegam Wash. Although several pestles were found in excavated areas at Gu Achi, this specimen is the only mortar noted at the site. This suggests the possibility that most mortars were made from wood.

A series of seven rock piles was observed in a 400+ sq. m area on top of a dissected bajada approximately 2 km northeast of Gu Achi. These were mounded clusters of unmodified river cobbles, about 1.5-2.0 m in diameter and 0.2-0.4 m in height (Fig. 47). The cobbles themselves ranged from 10 to 25 cm in diameter. Analogous features from other locations in southern

Fig. 47. Rock pile north of Anegam Wash between Gu Achi and the Black Hills, looking northwest.

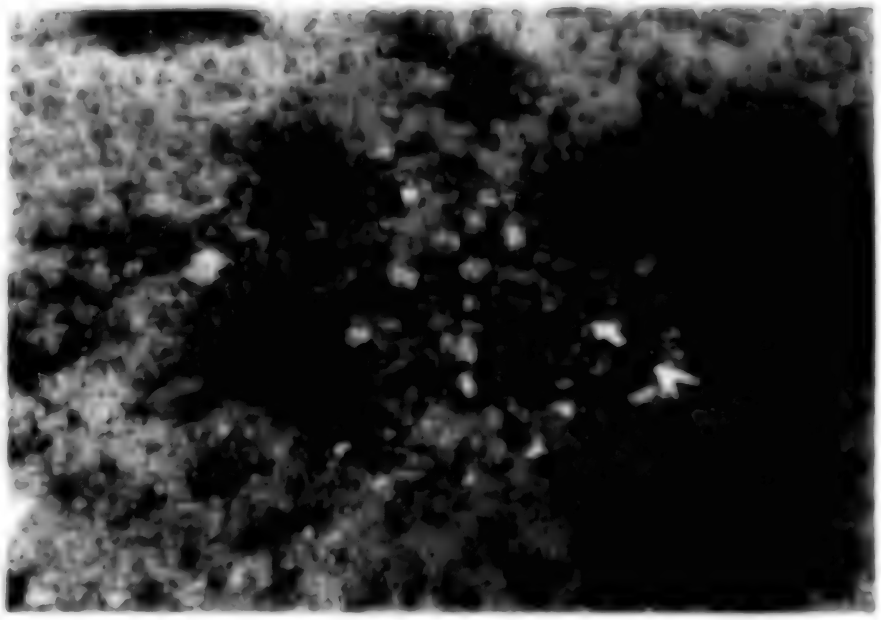

Fig. 48. Rock pile 50 m south of Gu Achi Wash, due south of the site of Gu Achi.

Arizona (see Masse in press b; in press c) indicate that these features result from clearing the bajada top for agriculture. This bajada is so situated that floodwater farming would not have been possible; thus, whatever crops were grown in this area would have been directly dependent upon rainfall. This suggests that true dry farming may once have been practiced in the Papagueria, an exciting possibility that has not been documented by previous work. A similar but isolated rock pile was found just south of Gu Achi Wash (Fig. 48). The dating of the rock pile features is insecure; however, since many of the cobbles are buried and some of the rock piles have large creosote bushes and cholla cactus growing out of them, they are not modern or recent historic. As such a practice has not been noted for ethnographic Pima and Papago populations, I suggest that the rock piles near Gu Achi are most likely prehistoric.

Three or four sherd and lithic concentrations were noted on the bajadas due south of Gu Achi and just south of Gu Achi Wash. These were light to moderately dense Sells phase scatters, each occupying an area of less than 10 sq. m. Because the soil mantle is gravel/cobble, it is probable that these features are the residue from wild plant gathering and, possibly, processing activities rather than from agricultural activities. Cultural manifestations were not observed on bajadas further west.

Approximately 1.5 km west of Locus OO on the north side of Gu Achi Wash was a large sherd and lithic scatter dating to the Sells phase. This site was 75 m in diameter. Most of it was situated on a small rise, possibly a terrace remnant, next to Gu Achi Wash. There was a heavy concentration of cultural material on the surface, and the spoil dirt from several rodent burrows suggested a considerable depth to the deposits. A carefully shaped and ground tabular knife, chipped stone debitage, plainware sherds, and a large number of Sells Red sherds were present. A heavily patinated basalt projectile point of Archaic age was also found in these deposits.

Curiously, in spite of the heavy concentrations of sherds, no decorated sherds were observed--unlike the Sells phase deposits at Gu Achi itself. The site lacked visible above-ground architecture, which might be expected at a site of this size. Possibly this site is either a major campsite, visited repeatedly over the course of several years, or perhaps a village site containing buried pit houses, such as those encountered at the early Sells phase site of Huihikiwani in the northwestern Papagueria (Rosenthal and others 1978: 28-39). The potential for answering questions about early Sells phase populations in the Papagueria makes this site a valuable resource for future research.

Chapter 4

MATERIAL CULTURE

More than 24,000 items, most of them potsherds, were collected during the survey and excavations at Gu Achi. By convention they have been grouped into three major categories--ceramics, lithics, and shell and worked bone. Throughout this discussion these items are compared with their counterparts at Snaketown and other southern Arizona Hohokam sites. Unfortunately, the quantity and type of artifacts illustrated here may not accurately reflect the nature of the archeological resources at Gu Achi. Few specimens from the Sells phase and from the transition between the Snaketown and Gila Butte phases were recovered during the course of the excavations. Most of the examples from these two periods were collected during the survey simply for illustration and to provide a tentative framework for material culture differences between the respective time phases at Gu Achi. An adequate sample of materials dating to the late Santa Cruz and early Sacaton phases was obtained, but the earliest and latest time periods are greatly underrepresented.

Ceramics

A total of 22,075 sherds and eight partially reconstructible plainware vessels were recovered from all phases of the work at Gu Achi. Of the total, 19,596 sherds (89%) were plainwares, 2401 (11%) were decorated, and 78 (less than 1%) were redwares. For the excavated ceramics percentages are the same, with 9902 (89%) plainware sherds, 1170 (11%) decorated, and 17 (less than 1%) redwares. It is reemphasized that these percentages reflect the nature of the late Santa Cruz/Sacaton phase assemblage and not the earliest and latest time periods at Gu Achi.

The discussion of ceramics is divided into three sections--plainwares, redwares, and decorated wares. Separate consideration is given to worked sherds, other eccentric forms, and the results of the petrographic analysis (Appendix G).

Plainware

As with most Hohokam sites, plainware pottery dominates the artifact assemblage from Gu Achi. It accounts for 89% of all ceramics found at the site and more than 80% of all artifacts recovered. This figure does not include 8721 smaller than thumbnail-size plainware sherds that were not analyzed because of their fragmentary and often heavily weathered condition. Most plainware pottery types are extremely friable, and nearly all of these sherds had suffered long exposure on the site surface or were broken during recovery. The omission of these sherds does not affect our interpretation of the plainware assemblage.

Plainware pottery types are generally given little emphasis in archeological analysis because it is felt they are not as sensitive to cultural and behavioral change as other classes of artifacts. Preliminary inspection of the Gu Achi plainwares indicated that several different pottery types were present in substantial numbers, an unusual situation for most Hohokam sites. Since Gu Achi is located in an area of potential contact with several regional Hohokam populations (Gila Basin, Tucson Basin, the "Desert Branch" Hohokam at Valshni Village, Gila Bend) as well as with two separate culture areas (the Trincheras and the Yuman), it seemed possible that the Gu Achi plainware assemblage might reflect important cultural, temporal, and perhaps functional variables. Therefore, an ambitious program of plainware analysis was set up to elicit some of this information. All of the plainware sherds were studied with the aid of a 10X hand lens, and nearly half were further scrutinized under a binocular light microscope with a power ranging from 25X to 100X for accurate identification of the temper in each sherd. A second feature of analysis was the finish on plainware sherds; were they hand-smoothed or stone-polished? Other attributes were the presence or absence of a carbon streak in the core, smudging, sooting, evidences of cooking stains, vessel wall thickness, vessel size and shape, and so on.

With temper and finish characteristics as the key criteria, more than 40 separate plainware pottery types were identified in the Gu Achi collection. However, several factors led to the eventual reduction of this large number of types. First, only a small percentage of the plainwares were hand smoothed, and several of these sherds fit with specimens that showed some polishing. Thus, it became obvious that not all vessels had been given an even, all-over finish. Also, the petrographic analysis (Appendix G) and consideration of provenience suggested that some temper differences, such as the presence or absence of certain minerals, simply reflected the use of slightly different local sources for clay and temper.

With these factors taken into consideration, the number of plainware pottery types at Gu Achi is reduced to 13 (see Tables 6 and 7). Only five of these types were produced in significant numbers at the site. In relative order of abundance these are tempered with schist (44%), altered andesitic(?) grus (20%), sand (10%), crushed altered andesite(?) with schist (9%), and crushed altered andesite(?) (9%). Gila Plain, the Hohokam utility ware of the Gila Basin, constitutes only 3% of the Gu Achi plainware assemblage. Representative specimens of these types are illustrated in Figures 49 and 50.

Classification of Plainware Types by Temper Content

Schist. Nearly half (8584) of the plainware sherds are tempered only with schist. The schist is fine-ground, crushed platelets that range in size from flecks less than 0.1 cm in diameter to large flat chunks greater than 0.5 cm in diameter. The obvious source for the schist is the southern tip of the Sheridan Mountains, a mile east of the site. The temper of this pottery type is almost never crushed to the degree seen in Gila Plain, and large platelets of schist are thus common in the schist-tempered pottery at Gu Achi. Frequently, so much temper is used that the schist platelets appear to be stacked on top of one another.

Altered andesitic(?) grus. In the original analysis of the plainwares, before the results of the petrographic analysis were available, a distinctive pottery type was noted. This was heavily tempered with large angular and rounded grains of unknown type. These grains were either gray or purplish-red in color with numerous opaque white spots intermixed. Petrographic

	Excavation Area 1	Excavation Area 2	Excavation Area 3	Excavation Area 4	Excavation Area 5	Excavation Area 6	Excavation Area 7	Excavation Area 8	Excavation Area 9	Excavation Area 10	Excavation Area 11	Excavation Area 12	Excavation Area 13	Excavation Area 14	Trench A	Locus D	Locus E	Locus K	Locus S	Locus T	Locus HH	Surface Quads	TOTALS
Schist	1784	675	458	417	71	57	36	115	7		3	2	8	51	81	22	19	15			1	4762	8584
Schist with sand	10	128	9	13							1								3		2	193	359
Altered andesitic(?) grus	281	172	434	365	86	57	16	36			5			4	48		2	1				2363	3870
Altered andesitic(?) grus with schist	405	8	1	1	1										1							48	465
Crushed altered andesite(?)	575	37	75	115	17	12	6	4			4			5	27							868	1745
Crushed altered andesite(?) with schist	1632	26	8	8	1	1		3							79							91	1849
Crushed altered andesite(?) with sand	1				1								1			1						50	54
Sand	222	293	145	240	20	7	11	13		2	1	4	6	7	46	2	12		10	5	1	902	1949
Gila Plain	169	71	34	55	4	3	3	4			1		2		3	4	1			3		263	620
White schist		1	1	1									32							1		36	72
Basalt							1															13	14
Yuman				2																			2
Stucco ware	13																						13
TOTAL	5092	1411	1165	1217	201	137	73	175	7	2	15	6	49	67	285	29	34	16	13	9	4	9589	19596
Too small for analysis	1038	596	611	837	75	102	41	73	5		7	14	35	30	157							2110	5721

Table 6. Plainware sherd totals by provenience.

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PAGE

	JARS		BOWLS		UNKNOWN FORM	TOTAL
	Body	Rim	Body	Rim		
Schist	1839	263	103	89	6290	8584
Schist with sand	89	18	12	6	234	359
Altered andesitic (?) grus	1022	104	13	14	2717	3870
Altered andesitic (?) grus with schist	203	21	1	3	237	465
Crushed altered andesite (?)	604	81	23	3	1034	1745
Crushed altered andesite(?) with schist	877	95	2	3	872	1849
Crushed altered andesite (?) with sand	17	3	7		27	54
Sand	554	84	19	33	1259	1949
Gila Plain	145	27	44	6	398	620
White Schist	17	3			52	72
Basalt	1	1	3		9	14
Yuman	1	1				2
Stucco ware	13					13
TOTAL	5382	701	227	157	13,129	19,596

Table 7. Plainware sherd totals by vessel form.

analysis has shown this temper to be an altered volcanic mineral, probably andesite. Either wash sand heavily laden with andesitic(?) "grus" (a state of decomposition) from a nearby source was used for temper in this pottery type, or the potter collected this grus from the source itself.

Sand. This pottery type is tempered with rounded grains of both opaque and clear quartz, along with occasional other minerals such as basalt, obsidian, altered andesite(?), and both biotite and phlogopite(?) mica. The characteristic rounding of nearly all particles indicates that the temper is derived from wash sands, perhaps from either Anegam or Gu Achi Wash.

Crushed altered andesite(?). This refers to plainware that contains sizeable numbers of platelets of a fine-grained mineral. The platelets are usually purple in color (though green and gray specimens are also known) and of the same size range as the schist platelets (0.1-0.5 cm). Frequently, the temper is so abundant that the platelets seem stacked on top of each other.

Petrographic analysis indicated that the purple mineral is probably altered andesite(?) that has been crushed for use as temper. Since this occurs as large crushed fragments, it probably comes from a less weathered source than the altered andesitic(?) grus. Petrographic analysis noted substantial amounts of "fine-grained unidentifiable material (clay?) having well-defined banding with variable reddish staining" in this type; these temper fragments contained much carbonaceous material. Loomis (Appendix G) suggests that these particles may be sherds (see Fig. 112). If so, this adds a new dimension to pottery manufacture at Gu Achi. The Hohokam of the Gila Basin apparently never tempered pottery with crushed sherds.

Crushed altered andesite(?) with schist. This plainware pottery type is simply the previously described type with the apparently purposeful addition of a fair amount of micaceous schist.

Gila Plain. Gila Plain is the plainware pottery type most commonly considered the Hohokam utility ware. Although adequate descriptions of this type exist (for example, Haury 1937: 205-211), there has been some confusion regarding its definition. For example, several studies have divided Gila Plain into varieties on the basis of the presence or absence of mica (finely pulverized micaceous schist) in the temper (for example, Wasley and Johnson 1965; Stewart and Teague 1974). Other studies have chosen to ignore temper and relied solely on vessel form, shape, and finish for classification (Doyel 1974; Yablon 1978).

In this analysis Gila Plain refers only to those specimens that have the shape and finish characteristics of the defined type and contain an abundant amount of pulverized micaceous schist. The presence or absence of mica in the temper may reflect either temporal or regional differences in Hohokam ceramic assemblages (Masse in press c, n.d.b).

Altered andesitic(?) grus with schist. This pottery type is the same as "altered andesitic(?) grus," but micaceous schist has been added.

Schist with sand. This is basically a sand-tempered pottery type in which small but noticeable amounts of crushed micaceous schist have been added.

Crushed altered andesite(?) with sand. Like "schist with sand" plainware, this appears to be a sand-tempered pottery type to which small amounts of crushed altered andesite(?) have been purposefully added.

White schist. During analysis, several distinctive schist-tempered sherds, especially from Excavation Area 13, were noted. In these specimens several of the schist particles have a white cast rather than the silver sheen of most micaceous schist. Petrographic analysis revealed these to be "strained" quartz, which formed much of the schist itself. This type of schist was also seen in Sells Red pottery of the Classic period, suggesting that this white schist was obtained during the Classic period from a different source than that used by the pre-Classic Hohokam.

Basalt. A few sherds at Gu Achi appeared to be liberally tempered with basalt-laden sands in which the basalt grains are quite angular. Possibly basaltic rock was also crushed for this temper. Only a small number of these sherds were found, all in surface quads or near surface contexts. The proveniences preclude satisfactory temporal placement and cultural interpretation.

Yuman. Two sherds, tempered with fine sand and hand-finished, of this type were found. A more complete description is provided in the discussion of intrusive wares.

Stucco ware. The sherds of this type were similar to those of crushed altered andesite(?). A more complete discussion is given in the section on intrusive wares.

Plainware Temporal Attributes

Snaketown/Gila Butte plainwares. The earliest ceramic assemblage at Gu Achi (Locus D) consists primarily of schist-tempered wares (Table 6). Only three other plainware types are present, including a few sherds of Gila Plain. Noticeably lacking are specimens with volcanic temper, such as crushed altered andesite(?) and altered andesitic(?) grus. A single sherd of altered andesitic(?) grus mixed with sand was recovered from Collection Area 4, Locus D. The andesitic(?) grus probably occurred naturally in the deposits where the temper for this vessel was collected. While the absolute frequencies of these plainware pottery types cannot be derived because of the small sample size, survey indicated that the relative frequencies at the site compare favorably with the collected sample. Schist-tempered plainwares were by far the dominant pottery type observed during the survey.

The schist-tempered plainware in Locus D shares several traits with contemporaneous sherds of Gila Plain at Snaketown. The two most obvious similarities are vessel shape and the thinness of vessel walls. The most common schist-tempered plainwares are somewhat globular jars with tall vertical necks and slightly to moderately outflaring rims. The rim finish often looks squared but is always slightly rounded. Some rims have walls slightly thicker than the rest of the vessel body, but generally rims were straight-sided and of the same thickness as the vessel body. The measurable jar rims had diameters between 20-30 cm, suggesting that the body diameters of the original vessels ranged between 30-45 cm. Such vessel sizes compare favorably with the Snaketown collection. The single schist-tempered bowl rim is from a hemispherical(?) vessel and has a thickened squared-off finish. The approximate rim diameter is 28 cm. Vessel wall thickness ranges from 0.3-0.9 cm, with the average being slightly under 0.5 cm.

The differences between the schist-tempered plainware of late Snaketown/Gila Butte phase at Gu Achi and contemporary Gila Plain at Snaketown primarily involve temper size and exterior vessel color. While the temper in early Gu Achi plainware is more finely ground than that of later time periods, it is coarser than the temper found in Gila Plain at Snaketown. The surface of Gila Plain literally sparkles when it catches light while schist-tempered plainware appears duller. Surface polish may also be a factor. The schist-tempered pottery at Gu Achi does not usually seem as polished as Gila Plain at Snaketown.

Gila Plain tends to be a light to moderate brown in surface color while the schist-tempered specimens at Gu Achi tend toward a darker (more chocolate colored) brown, as well as orange and red-orange. Both types exhibit the same degree of exterior surface mottling caused by fire-clouding. The four sherds in Locus D that were originally designated Gila Plain may have been produced locally. Their surface color tends toward red-orange, and although the temper is finely pulverized, it contains larger platelets of micaceous schist than are normally found in Gila Plain.

The sherd of "altered andesitic(?) grus with sand" is from a jar with features comparable to the schist-tempered plainware. The two sand-tempered specimens are from crudely made, hand-smoothed, shallow outflaring bowls. Both have rounded rim finishes, and vessel diameters are 16 and 22 cm.

Santa Cruz/Sacaton phase plainwares. While there are some continuities between the plainware assemblages of the late Snaketown/Gila Butte occupation at Gu Achi and the late Santa Cruz/Sacaton occupation (such as the continued dominance of schist-tempered vessels), there are at least two significant differences. First, in the late Santa Cruz/Sacaton phase large numbers of vessels are tempered with rock of volcanic origin. Second, vessel size greatly increases in the later period, both in terms of capacity and vessel wall thickness. Regrettably, no collections were made from late Gila Butte/Santa Cruz phase deposits to see if the changes are gradual or if they begin abruptly with the apparent population increase near the end of the Santa Cruz phase.

Five plainware pottery types appear to have fairly widespread distribution over the site during the transitional Santa Cruz/Sacaton phase (see Table 6). In descending order of frequency these are schist, altered andesitic(?) grus, sand, crushed altered andesite(?), and Gila Plain. Both crushed altered andesite(?) with schist and altered andesitic(?) grus with schist occur in large numbers in Excavation Area 1, but are rare in all other units. This distribution suggests that the two pottery types were made by a few potters during a relatively short period of time. The similarities in tempering, rim finish, and vessel size shared by the vessels tempered with crushed altered andesite(?) with schist suggest that they may have been the work of a single potter.

Although hundreds of sherds of each pottery type were found, many vessels were not necessarily present. For example, one reconstructible vessel tempered with crushed altered andesite(?) with schist (about 3/4 of the original vessel) consisted of 297 sherds having a combined weight of 12,957 g. Several of these sherds were larger than 100 cm^2. A quick calculation indicates that had all the sherds of this vessel been found, there would be nearly 400 individual sherds with a combined weight of about 17,300 g or 38 pounds. It is possible that the 465 sherds of altered andesitic(?) grus with schist came from only one or two vessels. The 1849 sherds of crushed altered andesite(?) with schist may have come from no more than five or six vessels. Thus, many of the plainware sherds recovered from Excavation Area 1 (Table 6) are probably from the eight identified reconstructible jars (Figure 10: Pots 1-8).

The plainware collection from Excavation Area 1 highlights both the great increase in size over earlier period ceramics and the predominance of volcanic-tempered plainwares. Most, if not all, of the eight jars around the ramada may be contemporaneous. The four pottery types represented by these eight jars--crushed altered andesite(?) with schist (3), schist (2), crushed altered andesite(?) (2), and altered andesitic(?) grus (1)--have similar sizes (diameters of 70-80+ cm) and shapes. Minor differences in rim finish, polishing, and other characteristics (Fig. 49) indicate that these may be the product of four different potters. This suggests that the ramada served more than one family at a time, a hypothesis that will be explored in greater detail in the next chapter.

Throughout all levels of Excavation Area 1 only 7% of the plainware rim sherds (17 out of 249) are from bowls; the remainder are from jars. When only levels at or near the occupation surface are considered, the difference is even more dramatic. Bowls then constitute only 2% of the rim sherds (2 out of 105). One of these is a scoop or shallow bowl of altered andesitic(?) grus, the bottom of which had been in contact with the red ochre layer in the eastern portion of the occupation surface. The predominance of jars over bowls suggests that cooking and storage were the primary

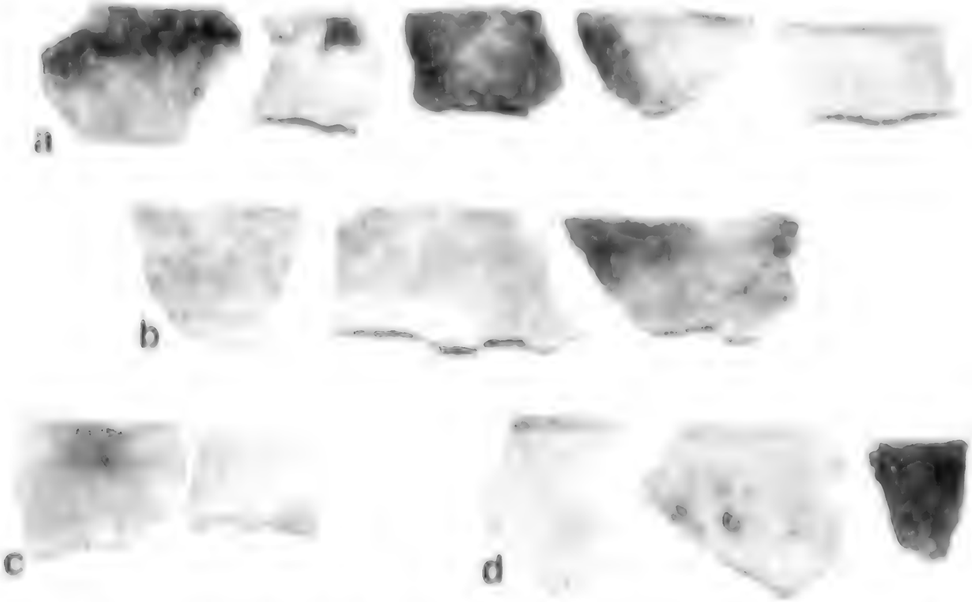

Fig. 49. Plainware rim sherds from Excavation Area 1. (a) schist; (b) crushed altered andesite(?) with schist; (c) crushed altered andesite(?); (d) altered andesite(?) grus. Length of largest sherd in (b), 22 cm.

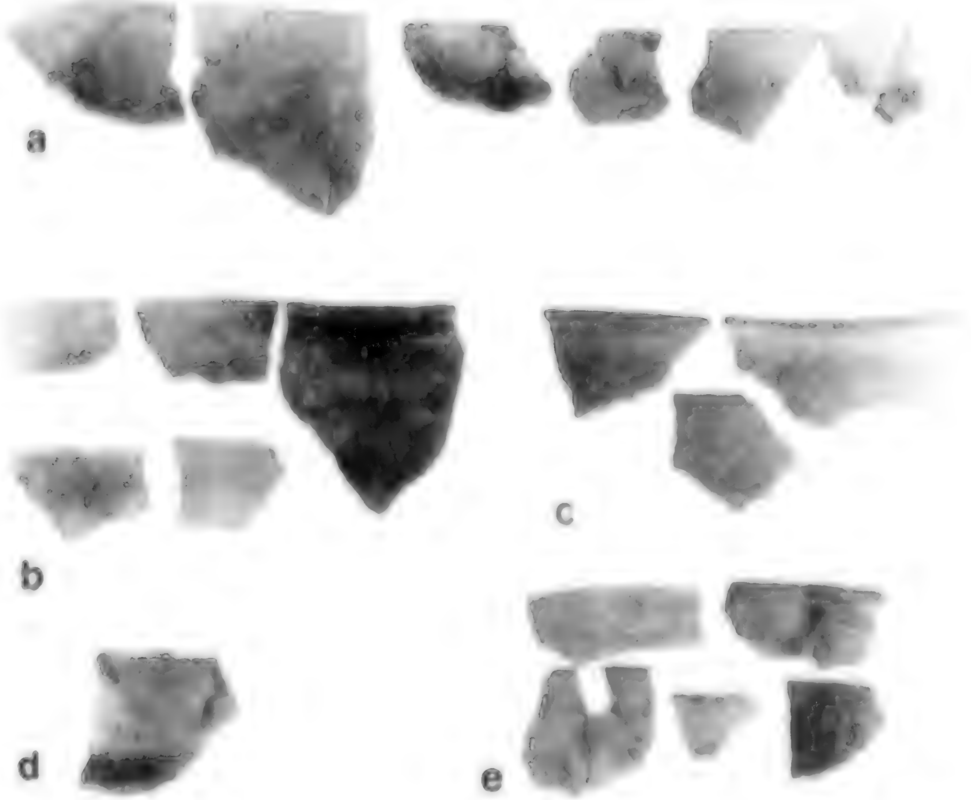

Fig. 50. Miscellaneous plainware rim sherds: (a) altered andesite(?) grus, (b) schist, (c) schist with sand, (d) crushed altered andesite(?), (e) Gila Plain. Length of largest sherd in (c), 14 cm.

functions of this assemblage. Storage has already been suggested because of the large size of the vessels and the presence of botanical remains associated with some jars.

The reconstructible vessels in Excavation Area 1 are extremely large. The crushed altered andesite(?) with schist specimens have rim diameters ranging between 42-56 cm and (for at least two vessels) body diameters in excess of 80 cm. Vessel wall thicknesses range between 0.5-1.6 cm, with an average of 0.7-0.9 cm. The schist-tempered plainwares have rim diameters between 32-40 cm and estimated body diameters greater than 70 cm. Wall thickness of these vessels ranges between 0.4-1.1 cm, with an average of 0.6-0.8 cm. Jars of these plainware pottery types are globular with moderate to long vertical necks and rims that are straight or slightly outflaring. In most cases the rim finish is squared off. The top of the rim is slightly thicker than the walls of the neck. The specimens of crushed altered andesite(?) and altered andesitic(?) grus are generally too fragmentary to yield reliable measurements. The rim diameter of one altered andesitic(?) grus vessel is 44 cm, and a diameter of 42 cm for a rim sherd of crushed altered andesite was estimated. In general, these latter types have the same rim characteristics as the types above, and they appear to fall within the same size ranges. The altered andesitic(?) grus specimen has a light scoring on the exterior. The scoring, horizontal near the neck and vertical on the sides of the body, was applied after the vessel was initially smoothed. No other vessel at Gu Achi has this scoring.

The forms of these eight vessels correspond to those described by Haury for the Santa Cruz and Sacaton phases at Snaketown (Haury 1976: 223-225). Some differences may be present, such as larger rim diameters and the lack of everted rims in the Gu Achi assemblage. The largest known vessel of Gila Plain at Snaketown is 85 cm in diameter (Haury 1976: 223). The fact that at least four and perhaps all of the vessels in Excavation Area 1 approach this diameter tells us that Gu Achi may have experienced the same population pressures and the same intensification of agriculture (and concomitant need for large storage containers) that Snaketown did.

Several sherds of the plainware in Excavation Area 1 have spots of organic residue. The nature of these spots and the patterns they compose preclude their being a product of firing or sloppy application of paint. Two categories of organic residue were recognized. One is termed "cooking spots" and consists of small spatters of residue adhering to the insides of jar sherds. Two examples are shown in Figure 51, one of which is a small sherd of crushed altered andesite(?) (Fig. 51c) and the other, a rim sherd of altered andesitic(?) grus with schist (Fig. 51a). A darkened band about 2 cm wide encircles the inside of the rim of the latter. It is possible the band was formed by cooking or burning some substance in the vessel while a fairly tight-fitting lid was secured.

The second type of organic residue is termed "drip mark." Two such specimens are depicted in Figures 51b and 55. These are both most likely from the same vessel tempered with crushed altered andesite(?) with schist. It is suggested that these drip marks were caused by some sugary substance that boiled over, dripped down the shoulders and sides of the jar, and was subsequently reduced to carbon by the fire over which the vessel was being used. Analogy with modern Papago sagauro syrup boiling activities suggests this.

The Papago jar illustrated in Figure 52 was used for many years to boil saguaro syrup (John B. Clonts 1978: personal communication). A pattern of drip marks, nearly identical to that on the Gu Achi specimens, can be seen on its shoulders. The drip marks on the Gu Achi specimen (Fig. 55) may result from a cooking activity such as saguaro syrup boiling, but the large size of the Gu Achi vessel (75+ cm in diameter) still needs to be explained. A cooking vessel this size has not been previously reported from a Hohokam site, and one must wonder about its function.

The question arises as to how representative of the entire site the plainwares from Excavation Area 1 are. This question can be answered by looking at the sizes, range of shapes, and rim finishes of vessels from other portions of the site. Samples of rim sherds were collected from the trash mound (Locus G) and from Locus R because of their considerable distance from Excavation Area 1, specifically for such a comparison.

On the whole, the specimens from Loci G and R averaged about 0.1 cm less in vessel wall thickness; however, a few specimens matched or exceeded those in Excavation Area 1. For example, one rim sherd of altered andesitic(?) grus from Locus R had a consistent thickness of 1.5 cm while another

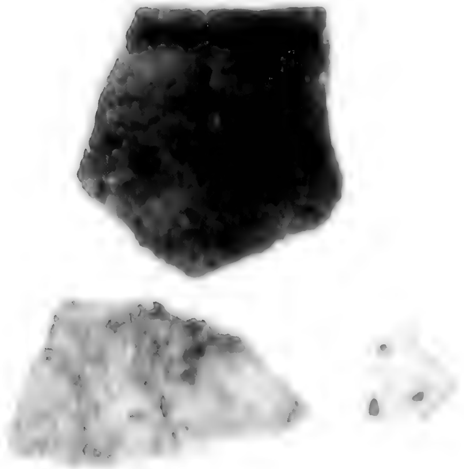

Fig. 51. Plainware sherds from Excavation Area 1 exhibiting burned organic residue ("cooking spots").

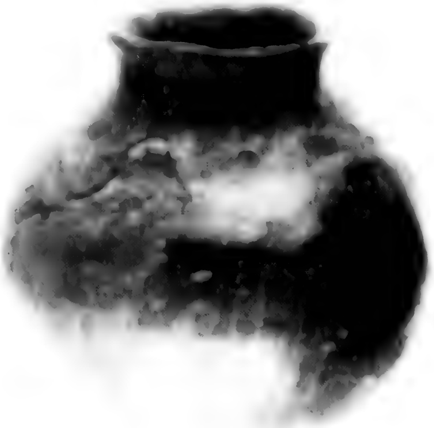

Fig. 52. Papago saguaro syrup boiling jar. Note drip marks on the lower portion of the shoulder.

Fig. 53. Large plainware jar sherd from Excavation Area 1 exhibiting distinct "drip marks."

sherd of altered andesitic(?) grus from Locus G had a maximum thickness of 2.2 cm. This sherd is probably from a jar bottom. No sherds large enough for reconstruction of body diameters were recovered from these two proveniences, but rim diameters seem comparable to those of Excavation Area 1. Schist-tempered specimens from the two loci ranged between 32-44 cm in rim diameter while the two measurable rims of altered andesitic(?) grus were 36 and 38 cm.

Vessel forms and rim finishes were more variable in Loci G and R than in Excavation Area 1. A much greater percentage of bowls was present in these two loci than in Excavation Area 1, but this difference may be due to the nature of sampling the loci. The jar forms are similar, but jar necks are shorter and tend not to flare outward as much as those from Excavation Area 1. Schist-tempered plainware seed jars and a small-mouthed jar add to the previously noted inventory of shapes. Bowls include outflaring, hemispherical, and incurving specimens with measurable diameters between 23-32 cm for schist-tempered specimens and 28 cm for a sand-tempered specimen. Rim finishes were thickened and squared off though straight-sided and rounded rims were also noted. A few bowl rim sherds had dark, possibly intentional, sooting on their interiors, but the interiors are not as well-polished as the Classic period smudged redwares in the Hohokam core area (Haury 1945: 82-83).

It is obvious that special activities, such as cooking and storage, were taking place in Excavation Area 1. However, since vessel shapes and sizes are similar at other loci in the site, other loci may be functionally similar. While Excavation Area 1 may have been the center for communal activity and storage, the present data do not seem to support such an hypothesis.

Sherds of Gila Plain from the late Santa Cruz/Sacaton phase at Gu Achi are more typical of the type as defined at Snaketown than Gila Plain from Gu Achi's earliest deposits. In vessel form and the abundance of mica particles, polishing, and striations, these closely resemble specimens from Snaketown. I suspect that most if not all of these sherds are intrusives from the Gila Valley but have no clear proof. The petrographic analysis of one Gila Plain sherd from the bell-shaped storage pit in Excavation

Area 1 is inconclusive. It is possible, even likely, that the Gila Plain vessels (predominately jars) at Gu Achi during the Santa Cruz/Sacaton phase transition are the containers for presently unknown items traded between the Gila Valley and Gu Achi (see Severson 1978: 128 for a similar argument on the presence of Gila Plain in the Sells phase).

Sells phase plainwares. So few plainwares were recovered from loci of known Sells phase age that little can be said about their shape, size, and vessel wall thickness. Jars appear to have short, somewhat vertical necks and moderately outflaring rims. The rims themselves are not usually thickened and are almost always rounded. The few bowl sherds seen suggest bowls that are straight-sided and hemispherical in shape. Two jar sherds, one finely tempered with white schist and the other sand-tempered, have a distinct mold-impressed shoulder, a hallmark of the Classic period (Haury 1945: 52).

Two attributes distinguish the Sells phase plainwares from earlier types. First, a dull white schist and sand were often used in the paste, and, second, most wares were highly polished. Even Sells phase sherds tempered primarily with silvery micaceous schist contain a few small platelets of white schist, as do some sherds of Tanque Verde Red-on-brown, especially those from Locus MM. Since all of the Sells phase ceramics were most likely imported, the identification of the home village for the Sells phase processing camps will be partly accomplished when the source of the white-schist-tempered ware is identified. Sand-tempered or schist-with-sand-tempered specimens, though, constitute the bulk of the Classic period plainwares. While the high degree of polish that occurs on most specimens of the Sells phase was present on some pre-Classic period wares, it formed a very small percentage (less than 1-2%) of all pre-Classic plainware specimens.

Discussion. With the exception of "Gila Plain," no formal type names have been employed for the Gu Achi plainware assemblage. This was done purposefully to avoid adding to the already confused picture of ceramic traditions in southern and southeastern Arizona. Had past ceramic analyses of the Papagueria been adhered to, other Gu Achi types with volcanic temper (crushed altered andesite(?), basalt, and much of the sand-tempered assemblage) would have been labeled "Sells Plain" (see Scantling 1940; Withers

1973; Severson 1978). Likewise, the schist-tempered and the crushed altered andesite(?) plainwares at Gu Achi would have been subsumed under the term "Wingfield Plain" (Goodyear and Dittert 1973; Weaver 1974; Raab 1976).

The areal distribution, longevity of manufacture, and even cultural affiliations of these formal pottery types remain open to discussion. For example, Wingfield Plain was initially described by Colton (1941: 48) as a paddle-and-anvil-thinned ware with coarse crushed mica schist temper and a rough, bumpy exterior. This pottery type was manufactured primarily in the Agua Fria and Verde Valleys (see Weaver 1974; Gumerman and Spoerl in press; Fish, Pilles, and Fish in press), but it has also been noted for the upper Santa Cruz Valley (DiPeso 1956: 349-350) and the Papagueria. Because of pronounced differences in vessel shape, size, wall thickness, finishing technique, and other attributes, I contend that the "Wingfield Plain" of southern Arizona (south of the Gila Valley) is a local manufacture and is not related to the Wingfield Plain in the Agua Fria and Verde Valleys. The only similarity is the presence of numerous large platelets of micaceous schist from crushed platelets of volcanic rock.

Similar problems occur with Sells Plain, though the differences are not as obvious. This subject will be examined in the discussion of the Quijotoa Valley Project in Chapter 6.

Redware

Redware ceramics are poorly represented at Gu Achi (see Tables 8 and 9). Only 78 sherds were collected, less than 1% of the total ceramic assemblage. Forty-two of these sherds are the Classic period type, Sells Red. Thus, only a maximum of 36 redware sherds may date to the pre-Classic period Hohokam occupation of the site. Twelve redware sherds that are not Sells Red were found in the 15 excavation units. A paucity of redwares is expected for a Hohokam site dating between about A.D. 500-1100, the major period of occupation at Gu Achi.

In addition to the Sells Red material, most of the redware sherds from Gu Achi can be divided into the established types, Rincon Red, Sacaton Red, and Vahki Red. A few sherds of a schist-tempered redware and several unidentifiable redware sherds complete the assemblage.

Sells Red. Sells Red is the redware of the Sells phase in the Papagueria. This pottery type was originally described by Scantling (1940) for Jackrabbit Ruin, where it constituted more than half of the ceramics found. Haury suggested that a similar situation existed at the Sells phase village of Ash Hill east of Gu Achi (Haury and others 1950: 346). Curiously, none of the Sells phase loci at Gu Achi have more than 5-10% numerically in comparison to other pottery types. This leads to questioning the nature of the relationship between the loci at Gu Achi and Ash Hill. Either the use of redware vessels was not encouraged for activities at Gu Achi, or the Gu Achi loci may relate to another nearby village where redware pottery was not used in great numbers. Also, Sells Red may have been produced in significantly different quantities during different portions of the Sells phase.

Most of the Sells Red at Gu Achi was from deep, straight-sided, slightly outflaring bowls. Bowl rim finishes are slightly rounded, and there is no thickening of the bowl rim as has often been noted in other Sells Red collections (for example, Severson 1978: 114). Vessel wall thickness ranged between 0.4-0.8 cm, with most specimens averaging 0.6 cm. Only two bowl diameter measurements were obtainable. One was 30 cm and the other, 36 cm. Some sherds had gray cores, and a few specimens contained bits of carbonaceous material. Four sherds that are from jars of unknown shape have darkly coated or smudged interiors. The Sells Red sherds at Gu Achi contain ground platelets of a white micaceous schist, and the slip on most specimens is thin and impermanent.

Except for the Gu Achi sherds that have a gray core, these specimens fit the published type description for Valshni Red, a late pre-Classic and early Classic period redware defined at Valshni Village (Withers 1973: 33-36). This may indicate that the Gu Achi Sells Red assemblage and the associated loci (especially Locus 404) date to early in the Classic period. The assemblage dates later than the Sacaton phase manifestations at Gu Achi because Sells Red occurred only in the highest excavation levels and on the site surface.

Rincon Red. Rincon Red is the companion ware to the Sedentary period decorated type, Rincon Red-on-brown, in the Tucson Basin. Rincon Red forms only a minor percentage of ceramic assemblages in the Tucson Basin (Greenleaf 1975a; Kelly 1978). It is somewhat of a surprise, therefore, to find 8 sherds, possibly representing four different bowls, at Gu Achi, especially since Rincon Red-on-brown is generally absent from site collections. These redware sherds are easily identifiable because a thick, well-polished slip is found on the interior and exterior of the vessel and because the coarse sand temper contains frequent flecks of mica. The original form of the bowls is not known, and the vessel wall thickness ranges from 0.4-0.8 cm. The presence of these sherds in association with the late Santa Cruz/Sacaton deposits in Excavation Area 3, Locus G (the trash mound), and Locus F further confirms the dating of these deposits.

Sacaton Red Decorated. This appears to be a previously unreported variant of the Sedentary period redware, Sacaton Red (Haury 1937: 202-204; 1976: 222-223). The scarcity of Sacaton Red in the Papagueria suggests importation from either the Gila Valley (near Snaketown) or, possibly, the Gila Bend region. The Gu Achi example is a bowl sherd, 0.5 cm thick, found on the surface of the BD Quad. The sherd has a lightly polished thin exterior and interior slip. A series of parallel lines in a darker shade of red is painted on the interior of the bowl (Fig. 63h). Another series of parallel lines diagonally joins the first set, but the design is two eroded to detail further. As an alternative to the designation of "Sacaton Red," Haury has suggested that this specimen is, rather, a red-slipped variant of Sacaton Red-on-buff (1979: personal communication). In this regard the temper of the Gu Achi sherd more closely resembles typical Gila Basin buffwares than coarser-tempered specimens of Sacaton Red. This is a unique sherd, and unless other such sherds from different vessels are found in the future, the Gu Achi specimen should not be given formal type or varietal status.

Vahki Red. Only two sherds of Vahki Red, the Hohokam redware associated with the Pioneer period, were collected from Gu Achi. A few additional sherds of this type were noted in Locus D. Both Gu Achi specimens are heavily tempered with mica, and both have the characteristically thin reddish-brown slip (Haury 1976: 222). These sherds range in thickness from 0.3-0.4 cm.

The fact that so few sherds of Vahki Red have been noted at Gu Achi gives added support to my belief that the colonization of Gu Achi was late in the Snaketown phase, at a time when the production of Vahki Red had all but stopped at Snaketown.

Schist-tempered redware. A small number of sherds of a red-slipped schist-tempered type were found in and around Excavation Areas 1 and 2. The paste of this redware did not differ from that of the schist-tempered plainwares. All of the nine specimens are bowl sherds and represent a minimum of 4-5 individual vessels. The slip is thin and lightly polished and only occurs on the inside of the bowls. Two vessel forms were identifiable--a deep, slightly outflaring bowl and a flare-rimmed bowl. The rim on the outflaring bowl was direct with a slightly rounded top. Somewhat imprecise measurements indicate that the rim diameter originally may have been as large as 60 cm. Vessel wall thickness ranged between 0.5-0.8 cm.

The interior slip and the association of this redware with deposits of late Santa Cruz/Sacaton phase age suggest that this pottery type is a local attempt to copy either Sacaton Red or Rincon Red.

Unidentified redwares. Sixteen redware sherds at Gu Achi were either too eroded to identify, or they did not match current type descriptions. Seven of these are jar sherds and nine are from bowls. Nearly all are tempered with sand. One jar sherd from the upper occupation level in Excavation Area 2 is painted only on the interior. This may have been a plainware (altered andesitic(?) grus) jar in which red pigment was stored.

An unusual redware jar sherd was found in the middle excavation levels (30-45 cm below the surface) in Excavation Area 5. This sherd has a thick, highly polished slip reminiscent of Classic period wares such as Salt Red (see Haury 1945). The temper of this paddle-and-anvil-thinned specimen included quartz, sand particles, abraded and rounded particles of phyllite, and what are almost certainly sherd fragments. This specimen is the only clear example of the use of sherd temper found at Gu Achi, though petrographic analysis (Appendix G) revealed that sherd temper may have been used in a few of the plainware pottery types as well.

Decorated Ware

A total of 2401 "decorated" sherds were collected during the fieldwork at Gu Achi (see Tables 8 and 9). More than 96% of these were Hohokam buff wares, which demonstrates the close affinity between Gu Achi and the Hohokam core area. Included in this total are more than 1000 undecorated buffware sherds that most likely represent the undecorated portions of decorated vessels or totally eroded portions of decorations. If these are eliminated from the decorated sherd counts, 93% of the decorated wares are red-on-buff, still a sizeable share. The decorated ceramics from Gu Achi are discussed as three categories, Gila/Salt Buffware Series, Tucson Basin Brownware Series, and Intrusive Decorated Ceramics.

Gila/Salt Buffware Series

In nearly every respect the Gu Achi collection of buffware ceramics duplicates the features reported from Snaketown (Haury 1937; 1976). Gu Achi, however, is distinguished by the lack of eccentric vessel forms and by a more limited range of design motifs.

Snaketown Red-on-buff. Only six sherds of Snaketown Red-on-buff were collected, and only a few others were noted on the survey. Because most of these sherds were small and eroded, reliable criteria for identification were the evenness and depth of the exterior grooving (Fig. [illegible]). Two bowls, two jars, and two unknown forms are represented. The bowls have outflaring rims while the jars are of unknown shape.

Transitional Snaketown/Gila Butte Red-on-buff. This is not a valid pottery type. Rather, it is included here to highlight characteristics transitional between these types that are exhibited by decorated ceramics in Locus D (see Haury 1976: Figs. 12.33b, 12.38a, 12.3[illegible]). Figure 56 illustrates this. Careful widening of the grooves between coils becomes more haphazard (Figs. 56b, d, g). The emphasis is still on rectilinear design, but hachure is being crowded together to form solidly filled areas (Figs. 56h, i). The predominate background color of these transitional sherds is lighter than that of most sherds of Snaketown Red-on-buff (Figs. 56d, f, g have a more typical Snaketown Red-on-buff color). Bowl sherds were more common than jar sherds, and the only identifiable forms are one shallow

	Excavation Area 1	Excavation Area 2	Excavation Area 3	Excavation Area 4	Excavation Area 5	Excavation Area 6	Excavation Area 7	Excavation Area 8	Excavation Area 11	Excavation Area 12	Excavation Area 13	Excavation Area 14	Trench A	AC Quad
Sacaton Red/buff	25	2	2	2	1									16
Transitional Santa Cruz/Sacaton Red/buff	16	15		2	2	10								26
Santa Cruz Red/buff	40	8	6	5	3	1							2	10
Gila Butte Red/buff			1	2										5
Transitional Snaketown/Gila Butte Red/buff														2
Snaketown Red/buff														1
Unidentified Red/buff	258	92	65	41	22	14		3		1		3	28	228
Undecorated Buffware	127	55	114	129	17		3	5		1		1	15	372
Tanque Verde Red/brown					1									2
Rincon Red/brown	1													4
Rillito Red/brown														1
Tamori Red/brown		3												
Unidentified Red/brown	1				1						1		1	10
Trincheras Specular Purple/red	1													
Trincheras Non-specular Purple/red									1					
Deadman's Black/red														
Black Mesa Black/white														
TOTAL	491	173	188	181	47	25	3	8	1	2	1	4	46	692
Sells Red				1				2						25
Rincon Red			3											
Sacaton Red Decorated														
Vahki Red														1
Sand with schist-tempered redware	5	3												1
Unidentified Redware	1	1			1									11
TOTAL	6	4	3	1	1			2						38

Table 8. Decorated and redware sherd totals by provenience.

NW Quad	NE Quad	SW Quad	Locus A	Locus D	Locus F	Locus G	Locus J	Locus B	Locus T	Locus S	Locus Y	Locus AA	Locus [illegible]	Locus [illegible]	Locus [illegible]	Miscellaneous Surface	TOTALS
	2	1			1			5								5	62
1	2	.					1	1					5			13	116
	1	2				2				1		1	10			14	125
	8	1						1					1				19
1				14													17
				2												1	6
10	52	38						1								19	651
10	65	202											1			1	1116
6	3	5	1								1			1	5	18	45
		1														1	5
		1						1									3
																	1
5									1	1			2				73
	1															1	3
				1													1
						1											1
						1											1
51	111	255	1	17	1	4	1	8	1	3	1	1	15	1	5	75	2873
	6	2													1		11
		1				1		1									5
		1															1
				1													1
																	5
1																	16
2	10	4		1		1		3							4		79

Table 6. (continued)

Fig. 34. Snaketown Red-on-buff sherds.

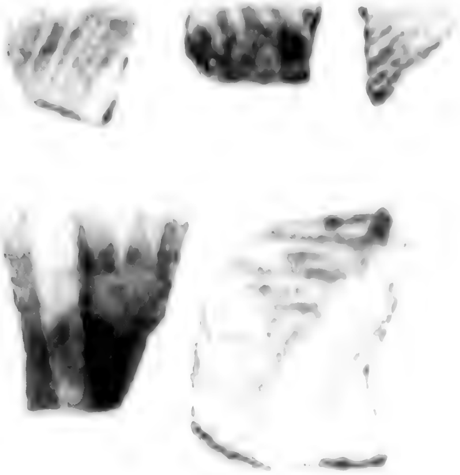

Fig. 35. Early Gila Butte Red-on-buff sherds from Locus D.

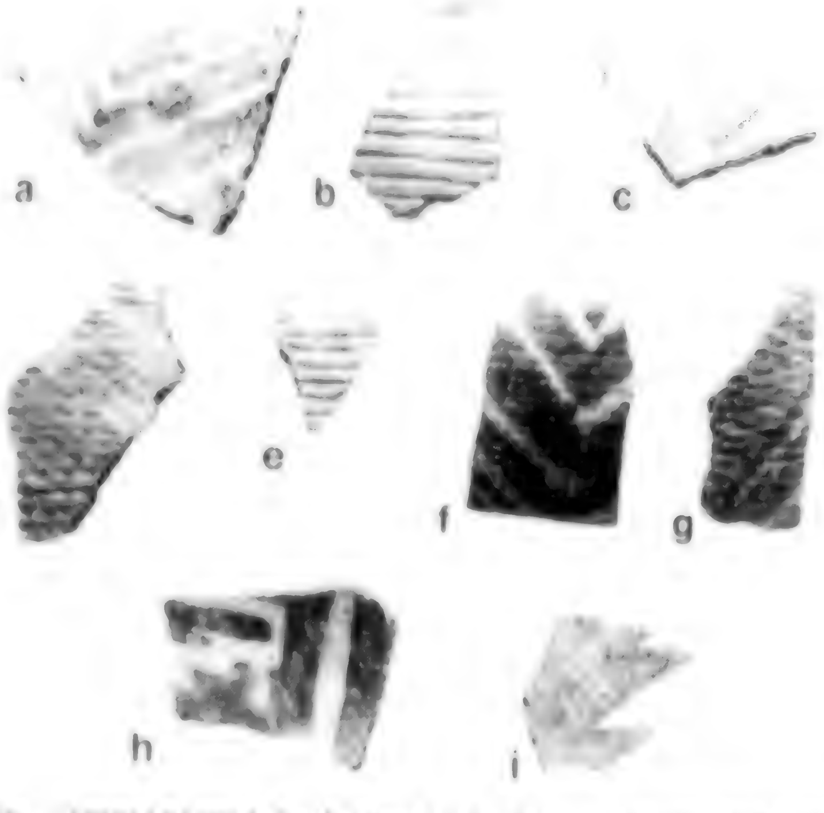

Fig. 36. Transitional Snaketown/Gila Butte Red-on-buff sherds from Locus D. (a) is from AB Quad.

	Jars		Bowls		Other	Unknown	TOTAL
	Body	Rim	Body	Rim	Forms	Form	
Sacaton Red/buff	15		20	27			62
Transitional Santa Cruz/Sacaton Red/buff	29	4	30	30		23	116
Santa Cruz Red/buff	44	9	47	22	1*	2	125
Gila Butte Red/buff	6	1	3	3		6	19
Transitional Snaketown/ Gila Butte Red/buff	5		4	8			17
Snaketown Red/buff	2		1	1		2	6
Unidentified Red/buff	187	8	316	154	1**	186	852
Undecorated buffware	73	3	60	76		906	1118
Tanque Verde Red/brown	26	1	4	14			45
Rincon Red/brown	3			2			5
Rillito Red/brown	1		2				3
Vamori Red/brown			1	2			3
Unidentified Red/brown	12	1	3	2	1***	4	23
Trincheras Specular Purple/red			3				3
Trincheras Non-specular Purple/red	2						2
Deadman's Black/red			1				1
Black Mesa Black/white			1				1
TOTAL	405	27	496	341	3	1129	2401
Sells Red	4		13	11		14	42
Rincon Red			8				8
Sacaton Red decorated			1				1
Vahki Red	2						2
Sand with schist-tempered redware			8	1			9
Unidentified redware	5		11				16
TOTAL	11		41	12		14	78

*Miniature seed jar **Effigy vessel foot ***Censer

Table 9. Decorated and redware sherd totals by vessel form.

greatly outflaring bowl with a rim diameter of 30 cm and a rather deep bowl with slightly outflaring rim with a rim diameter of 34 cm.

Gila Butte Red-on-buff. Sherds of Gila Butte Red-on-buff were spread more widely over the surface of the site than the earlier ceramics. Gila Butte Red-on-buff was found throughout Locus D and in most loci north of its western end. Many sherds of this type were heavily eroded and could only be identified by the presence of exterior incising. The sherds depicted in Figure 55 are from Locus D. They seem to represent the early Gila Butte phase. Vessel forms include deep slightly outflaring bowls, shallower more outflaring bowls, and a seed jar. The few measurable bowl rim diameters were about 26-28 cm.

Santa Cruz Red-on-buff. Santa Cruz Red-on-buff is one of the most common decorated pottery types at Gu Achi. It is present in virtually every pre-Classic period locus except the earliest portions of Locus D. However, the majority of sherds classified as Santa Cruz Red-on-buff are stylistically late in the phase. This fact reinforces the idea that the Gu Achi population increased in the latter half of the Santa Cruz phase.

There is a wide range of decorative motifs in the Gu Achi collection of Santa Cruz Red-on-buff. This includes repeated unit geometric elements (Figs. 57a, k), the curvilinear scroll (Figs. 57b, f, n, o), animal (Figs. 57g, h, j), and human (Fig. 57i) life forms. The life forms illustrated on the cover of this volume are taken from sherds of Santa Cruz Red-on-buff found at Gu Achi (Figs. 57g, i, j). The most common design elements at Gu Achi during the Santa Cruz through early Sacaton phase is a combination of curvilinear scrolls and parallel rows of straight or squiggly lines (Fig. 57n).

Despite the large number of designs employed on Santa Cruz Red-on-buff, the number of vessel forms is quite limited. Except for one or two examples of straight-sided outflaring bowls, all bowls were of the flare-rimmed variety and had rim diameters between 20-36 cm. Jar forms included a single small seed jar (Fig. 57c) with a rim diameter of 6-8 cm. Most jars were small and squat, with rounded shoulders and outflaring rims. The one measurable specimen had a rim diameter of 20 cm.

Transitional Santa Cruz/Sacaton Red-on-buff. The "transitional" designation for these ceramics is not intended to create a new type name. Rather, these sherds share certain characteristics of Santa Cruz Red-on-buff and Sacaton Red-on-buff. The specimens depicted in Figure 58, clearly show some aspects of this transition. Whereas Santa Cruz Red-on-buff tends to be finely made, "the best in the line" of Hohokam ceramic types (Haury 1976: 210), the transitional Santa Cruz/Sacaton Red-on-buff assemblage used broader line work, more sloppily applied, had larger vessels with thicker walls, and did not emphasize the use of life forms. Some Santa Cruz phase traits were retained, such as widely spaced trailing lines on the outside of flare-rimmed bowls, but Sacaton phase traits, including the everted rim and sharp "Sacaton" shoulder, first appeared at this time on two shouldered jars of the transitional type. The field of decoration, which cannot be seen completely without picking up the vessel, extends far below the shoulder. Flare-rimmed bowls were still common, but straight-sided outflaring and hemispherical bowls increased in number. Bowl diameters in excess of 40 cm are found in the assemblage. The diameter of one illustrated jar (Fig. 58m) approaches 50 cm. In terms of vessel shapes, design motifs, and general technology, the transitional Santa Cruz/Sacaton Red-on-buff assemblage at Gu Achi closely resembles specimens from Snaketown that Haury considered early Sacaton (1976: 208, Figs. 11.7, 11.8, 11.9, 12.22, 12.23).

While slightly higher counts of Santa Cruz Red-on-buff were obtained at Gu Achi, the survey indicated that transitional Santa Cruz/Sacaton Red-on-buff predominates in all but the earliest of the pre-Classic period loci. A best-guess estimate of the ratio of Santa Cruz Red-on-buff to transitional Santa Cruz/Sacaton Red-on-buff at Gu Achi shows the latter would dominate with a ratio of 2 to 1 or even 3 to 1. This estimate should be validated by future testing.

Sacaton Red-on-buff. It is much more difficult to separate the transitional Santa Cruz/Sacaton Red-on-buff from Sacaton Red-on-buff than from Santa Cruz Red-on-buff in the Gu Achi collections. Nearly all sherds that can be classified as Sacaton Red-on-buff have shapes and design styles that are more characteristic of the early portion of the Sacaton phase (as defined at Snaketown) than of the late portion. Late Sacaton characteristics, such as straight jar necks and rims, design panels with emphasis on rectilinear

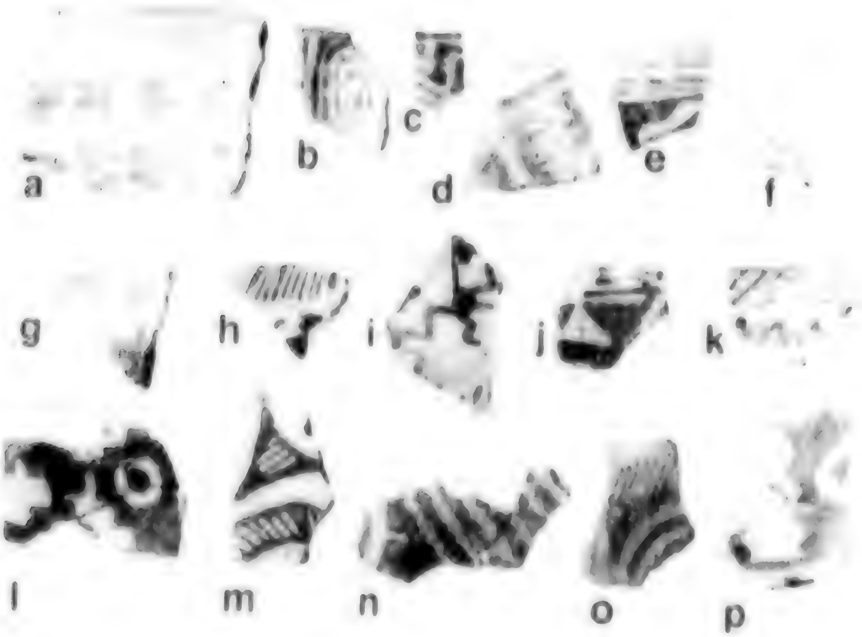

Fig. 37. Santa Cruz Red-on-buff sherds.

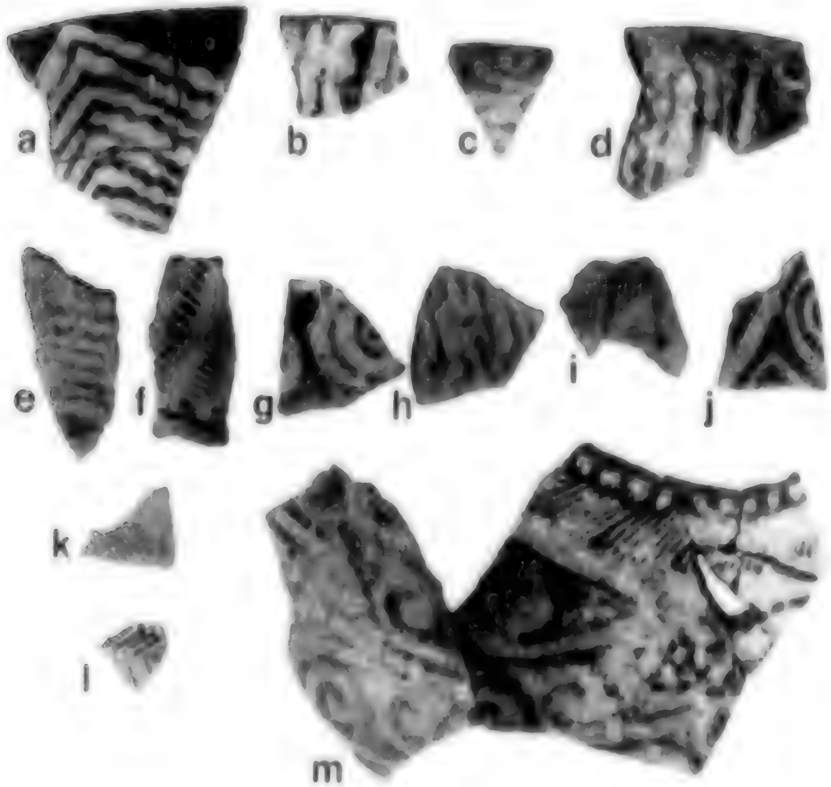

Fig. 38. Transitional Santa Cruz/Sacaton Red-on-buff sherds.

scrolls and barbed lines, the gradual rounding out and disappearance of the Sacaton shoulder, and design elements such as the free line neck squiggle on jars and straight-line hachure-filled bands framed by serrated lines are virtually absent.

The Gu Achi collection of Sacaton Red-on-buff is characterized by broad-line, highly convoluted scrolls (Fig. 59f), broad squiggle lines (Figs. 59a-c), and a pronounced use of solid areas with unit geometric designs. One instance of a straight-line, hachure-filled band was noted (Fig. 59g), but the shape of the shoulder and the continuation of the design well below the shoulder suggest that this piece was made early in the Sacaton period. Sacaton Red-on-buff vessel shapes and sizes mirror those of transitional Santa Cruz/Sacaton Red-on-buff, with perhaps a slight decrease in the number of flare-rimmed bowls and an increase in straight-sided forms.

No sherds of the Classic period pottery type Casa Grande Red-on-buff were noted in the collections from Gu Achi. However, several sherds from a single Casa Grande Red-on-buff jar were seen on the reservoir (Locus A) embankment. This vessel had a high vertical neck and rectilinear designs, indicating that the jar was associated with the Sells phase occupation of Gu Achi some time after A.D. 1150-1200.

Unidentified red-on-buff and undecorated buffware. A large percentage of the total buffware assemblage recovered from Gu Achi is either unidentifiable (37%) or undecorated (48%). Many of these sherds were collected from the site surface, where exfoliation of designs and the mechanical breakdown of the sherds by sheet flooding, cattle or other animals walking through the area, and other such events are continuous processes. Several of the sherds associated with the occupation surfaces in Excavation Areas 1 and 2 present a similar "weathered" appearance. Where hard-packed surfaces are lacking, it may be possible to define "stable" (that is, exposed for long periods of time to the previously mentioned processes) prehistoric occupation surfaces by the presence of layers of such weathered ceramics.

The unidentified and undecorated buffware sherds do not add much significant information to the discussion of identified specimens. The location of these sherds within the site and the presence of such diagnostic forms as flare-rimmed bowls and shouldered jars indicate that most of these specimens date to the Santa Cruz and Sacaton phases. Fragments of two scoops and a foot from a legged vessel, probably an effigy vessel, are the only additional vessel forms not previously noted at Gu Achi. The legged vessel fragment (Fig. 66b) was found on the surface of the AC Quad and is most likely late Santa Cruz or early Sacaton Red-on-buff. Another fragment of a legged vessel found nearby is from a different vessel, possibly a three-legged plate similar to specimens reported from Snaketown (Haury 1976: Fig. 12.20a). This vessel should also date to the Santa Cruz/Sacaton phase.

Tucson Basin Brownware Series

Ceramics of the Tucson Basin series (see Greenleaf 1975a; Kelly 1978) found at Gu Achi include small numbers of sherds of Rillito Red-on-brown and Rincon Red-on-brown and much larger numbers of Tanque Verde Red-on-brown (Vamori Red-on-brown is also included with the Tucson Basin ceramics). There seems to be little doubt that the Rillito and Rincon Red-on-brown are intrusive to the site of Gu Achi, probably from the Tucson Basin. The Tanque Verde Red-on-brown, though included in the Tucson Basin ceramic series, was probably also produced in the Papagueria (see Scantling 1940; Hayden 1957: 216-219).

Rillito Red-on-brown. Rillito Red-on-brown is the Tucson Basin equivalent of Santa Cruz Red-on-buff. The dating of this type roughly approximates the duration of the Santa Cruz phase, about A.D. 700-900. Three specimens were found at Gu Achi, a bowl fragment from the surface of Locus R (Fig. 63e), a jar sherd from the surface of the AC Quad, and a bowl fragment from the surface of the BD Quad. Because of the broad line-work, the design motifs, and the thickness of the vessel walls (0.6-0.7 cm), these three specimens were probably manufactured late in the Santa Cruz ("Rillito") phase.

Rincon Red-on-brown. Stylistically and temporally, this Tucson Basin ceramic type is the equivalent of Sacaton Red-on-buff. The stylistic divergence between Rincon Red-on-brown and Sacaton Red-on-buff is somewhat greater than that between Rillito Red-on-brown and Santa Cruz Red-on-buff, and there is some evidence (not firm, however) that Rincon Red-on-brown may have survived later than Sacaton Red-on-buff (Greenleaf 1975a: 60).

Five sherds of Rincon Red-on-brown were found at Gu Achi. Two of these were from the surface of the AC Quad and are stylistically early in the Sacaton ("Rincon") phase. One is the rim from a slightly outflaring bowl while the other is from a flare-rimmed bowl about 28 cm in diameter. Two jar sherds exhibit complex designs of repeated geometric elements. One of these was found above the occupation surface of Excavation Area 1 near Hearth 1 while the other (Fig. 63f) was on the site surface south of the reservoir (Locus A). A third jar sherd (Fig. 63g) was recovered from an unknown provenience on the site surface. The barbed-line motif on this sherd was common during the middle and late portions of the Sedentary period, but the specimen could possibly be either Cortaro or Tanque Verde Red-on-brown, Classic period types.

Vamori Red-on-brown. As originally defined at Valshni Village, Vamori Red-on-brown was believed to have been an indigenously produced Papaguerian pottery type of the pre-Classic period (Withers 1973). Haury (Haury and others 1950: 12) later designated this the earliest decorated ware produced by the "Desert Branch" Hohokam. Review of the original type description (Withers 1973) and personal inspection of the Valshni Village collections in the Arizona State Museum causes me to question the validity of a separate type distinction for Vamori Red-on-brown. Vamori Red-on-brown shares a similar technology and a number of similar design motifs with Rillito and Rincon Red-on-brown. Because my examination of the Valshni Village collection was not detailed enough to define with certainty the connection between Vamori Red-on-brown and the pre-Classic period Tucson Basin wares, Vamori Red-on-brown is considered a separate type in this analysis. However, a more thorough examination of this problem may result in reclassifying Vamori Red-on-brown as a regional variant of Rillito and/or Rincon Red-on-brown.

Three sherds of one small, slightly outflaring bowl of Vamori Red-on-brown were found on the upper occupation surface in Excavation Area 2. The bowl interior is decorated with a series of vertical squiggle lines (Figs. 63a, b) while the weathered exterior is of undetermined nature. The vessel has been only lightly polished. The core color is reddish orange with no carbon streak. The diameter of the bowl is only 12 cm, considerably smaller than specimens of the type at Valshni Village, where diameters ranged between 20-38 cm (Withers 1973: 25).

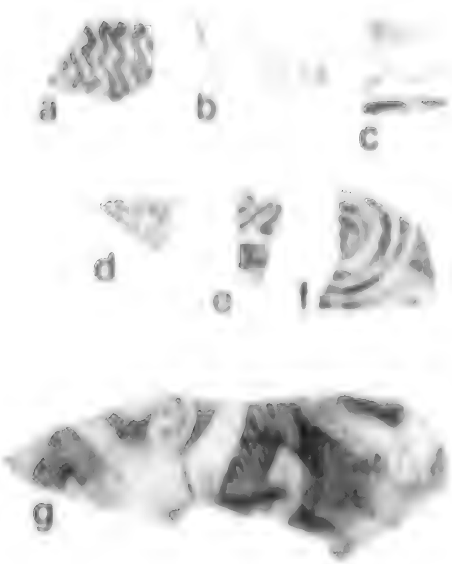

Fig. 39. Early Sacaton Red-on-buff sherds.

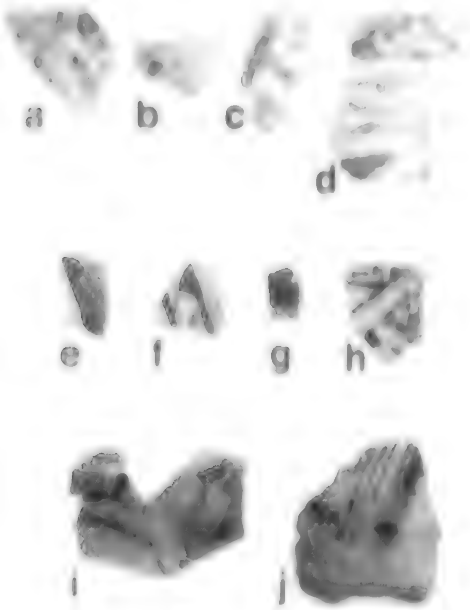

Fig. 40. Tanque Verde Red-on-brown sherds.

Tanque Verde Red-on-brown. Tanque Verde Red-on-brown is the dominant decorated pottery type in the Tucson Basin and the Papagueria during the Classic period. Tanque Verde Red-on-brown shares many features with Casa Grande Red-on-buff, its Hohokam core area equivalent. These include globular, somewhat vertically compressed jars with high vertical necks and degenerate or rectilinear designs. There are major differences between the wares, however. Tanque Verde Red-on-brown apparently was produced in significantly greater numbers than Casa Grande Red-on-buff, and bowls are common for Tanque Verde Red-on-brown but very rare in Casa Grande Red-on-buff.

Although only 35 sherds of Tanque Verde Red-on-brown were collected and analyzed, about three or four times that number were noted during the survey. A representative sample of this pottery type is illustrated in Figure 40. Common vessel forms at Gu Achi included deep, straight-sided hemispherical bowls, deep bowls with slightly flaring rims and recurved rims, and a globular jar with tall, vertical neck of narrow diameter. The last example had a neck at least 9 cm in height.

The tall-necked specimen (Fig. 40d) is decorated with a running band of "Y" motifs. This is an unusual motif for either Tanque Verde Red-on-brown or Casa Grande Red-on-buff. However, it occurs quite commonly on Gila Polychrome (see, for example, Haury 1945: 78) and Showlow and Fourmile Polychrome (Carlson 1970: 69-75) during the 14th century. While the nature of the relationship between the Classic period Sells phase population and groups in east-central Arizona is not clear, the use of the "F" motif on the Gu Achi specimen probably dates its manufacture to sometime after A.D. 1300. Because of the lack of Gila Polychrome and other 14th century intrusive pottery types at Gu Achi, this specimen gives us our only firm evidence that resources at Gu Achi were being utilized at the same time as the occupation of the late Sells phase village of Ash Hill two miles east.

The dating of most other specimens of Tanque Verde Red-on-brown at Gu Achi cannot be more closely defined than "Sells phase" or A.D. 1150-1200 to A.D. 1450. Design elements such as cross-hachure (Figs. 60e, g), rectilinear scrolls (Figs. 60d, h), and crossed (Figs. 60a, j), barbed (Fig. 60i), and ticked (Figs. 60d, j) lines seemingly occur throughout the duration of the pottery types. However, three specimens collected from Locus MM and one from an unknown surface provenience may be an early variant of Tanque Verde Red-on-brown. The sherds from Locus MM represent three different hemispherical bowls. The bowls all had exterior decoration. One had a rectilinear design, but the others are too heavily eroded to discern. The interiors are decorated with a series of parallel rim bands. One vessel has three squiggly lines, the second has at least four straight lines, and the third has two and perhaps three parallel squiggly lines. Wall thicknesses range from 0.5 to 0.8 cm. The sherds are all highly polished, which differs from the norm for "Topawa" Red-on-brown, the pottery type at Valshni Village that is supposedly transitional between Vamori Red-on-brown and Tanque Verde Red-on-brown (Withers 1973: 27). Also, the Valshni Village assemblage of "Topawa" Red-on-brown does not have interior parallel rim bands. The closest comparative specimens to these three sherds from Locus MM are interior border bands of unknown Classic period age reported from the Hodges Ruin in Tucson (Kelly 1978: 57). Greenleaf's (1975a) study of late Rincon Red-on-brown ceramics did not reveal similar elements at Punta de Agua in the Santa Cruz Valley.

The possibly early Tanque Verde Red-on-brown sherd from an unknown provenience has both exterior and interior design. The exterior design is composed of two series of parallel lines forming a chevron-like pattern, with what appears to be the beginning of a diagonal row of ticking (Fig. 66h). The interior design is too incomplete for recognition but is not merely rim banding. The general lack of polishing on this specimen and the exterior design compare favorably with "Topawa" Red-on-brown at Valshni Village (Withers 1973: Fig. 15). The design treatment of the Gu Achi sherd also resembles jar exteriors and bowl interiors of late Rincon Red-on-brown at Punta de Agua (Greenleaf 1975a: Figs. 3.14, 3.16, 3.19).

While the evidence is not overwhelming, these four sherds of Tanque Verde Red-on-brown are probably the earliest Classic period decorated ceramics at Gu Achi, and Locus MM represents the earliest Classic period area occupied at the site.

Unidentified red-on-brown. Twenty-three red-on-brown sherds unidentified as to type were collected from Gu Achi. Most of these are probably eroded specimens of Tanque Verde Red-on-brown. However, one fragment of a censer was recovered from early Sacaton phase deposits in Locus T. This specimen is sand-tempered; small amounts of naturally occurring muscovite mica and tiny particles of an unknown reddish-brown mineral are also present in the temper. The diameter of the vessel is 10 cm, and the thickness of the rim is approximately 1.3 cm. The censer fragment is heavily eroded, and it is impossible to determine the pottery type represented by this specimen. The temper and the provenience combine to suggest that the censer typologically may have been Rincon Red-on-brown traded into Gu Achi from the Tucson Basin.

Intrusive Ceramics

Apart from the Tucson Basin ceramic series discussed above, 10 sherds and one vessel, representing six different pottery types, appear to have been imported to Gu Achi from adjacent or distant regions.

Trincheras Purple-on-red. Five sherds and a reworked vessel of Trincheras Purple-on-red were found at Gu Achi. Trincheras Purple-on-red is the decorated ware of the prehistoric Trincheras culture of northern Sonora. The ceramics of the Trincheras culture have been studied and reported on by

Johnson (1960; 1963) and more recently by Bowen (n.d.). Unfortunately, as these authors have pointed out, our knowledge of the Trincheras culture is severely limited by the lack, to date, of work in sites with good stratigraphy.

Johnson (1963) has suggested that the Trincheras culture flourished between A.D. 800-1100 and that all of the Trincheras Purple-on-red pottery found in southern Arizona sites probably dates to this time period. Bowen (n.d.), on the other hand, feels that the Trincheras culture and pottery had considerable time depth. He recognizes two types of Trincheras decorated pottery. Both have essentially the same designs, but one is slipped ("Trincheras Purple-on-red") while the other is not ("Trincheras Purple-on-brown"). Bowen believes that Trincheras Purple-on-brown was manufactured from the beginning of the Trincheras culture (300 B.C.(?)) to its demise around A.D. 1400 (n.d.: 143). He suggests that "Purple-on-red" may be fairly late in Trincheras culture history but that Purple-on-brown remained essentially unchanged. I suspect that Trincheras decorated pottery had a longer life span than suggested by Johnson, but it is unlikely that it remained static for 1700 years, or even 1000 years, in a region that is bordered by the great Mesoamerican societies to the south and the less complex, but still enterprising Hohokam to the north. Trincheras culture chronology and pottery typology is still poorly understood.

The provenience and nature of the Gu Achi specimens, unfortunately, do not shed much light on the typology. One sherd was found in an erosional channel in Collection Area 6 of Locus D (Fig. 63d). The associated material culture seems to date to the late Snaketown/Gila Butte phase transition. Thus, it is likely that the Trincheras Purple-on-red sherd dates to this early time period. The sherd itself is from a jar. The interior has the deep scoring characteristic of this pottery type while the exterior has a cross-hachured design. Vessel wall thickness ranges between 0.4-0.6 cm.

Two bowl sherds recovered from the surface of Gu Achi (PC Quad and Miscellaneous Surface) are of little diagnostic value because of their eroded nature. They were recognized by their somewhat fugitive — slip and by traces of specular hematite from the original painted designs. Withers (1973) noted two varieties of Trincheras Purple-on-red. One exhibited a dull, flat painted decoration. The other literally sparkled because of specular iron ore crystals in the pigment. This distinction was retained for the present analysis, but many different factors, such as firing conditions, polishing techniques, and erosion of the pigment, can erase or heighten the specular appearance of the paint on a given pot (Bowen n.d.: 79-80).

Two other sherds of Trincheras Purple-on-red were recovered from the upper levels of Excavation Areas 1 and 11. The sherd from Excavation Area 1 is from a bowl. It has a design of broad parallel squiggly lines with highly visible specular iron crystals (Fig. 63c). The other sherd, from a jar, has the typical scored interior with a faint design (parallel squiggly lines?) on the exterior.

The most interesting and unusual ceramic object recovered from Gu Achi is a reworked vessel of Trincheras Purple-on-red. This vessel was found lying on its side on the occupation surface of the ramada structure in Excavation Area 1. This unique shape (Figs. 61, 62) resulted from reworking the top portion of a much larger bilobed vessel. Because this is the only reported instance of a Trincheras Purple-on-red bilobed vessel, one might be uneasy about the vessel's original shape except for two things. First, the top of the painted design that had apparently covered the lower lobe of the vessel can still be seen at the bottom of Figure 61. Further, there is a complete bilobed Trincheras Purple-on-red vessel in the collections of the Arizona State Museum. The latter vessel was found by members of the Van Bergen-Los Angeles County Museum expedition of 1929-1930 (Woodward 1931) at the Colonial/Sedentary period Grewe site (near Casa Grande National Monument). In practically all characteristics the bilobed vessel from the Grewe site is similar to the Gu Achi specimen.

Maximum height of the Gu Achi specimen is 7.9 cm. The diameter of the upper lobe is 8.8 cm; the diameter of the "base" (that is, the top of the lower lobe) is 7.6 cm; mouth diameter is 3.7 cm. The vessel wall thickness at the base is 0.6-0.7 cm. The base of the vessel has been ground smooth and repainted. Only rarely are the edges of reworked vessels repainted. The new paint lacks the specular iron ore crystals present in the pigment on the rest of the vessel, and I suspect that it was applied by the Hohokam, rather than by the Trincheras culture.

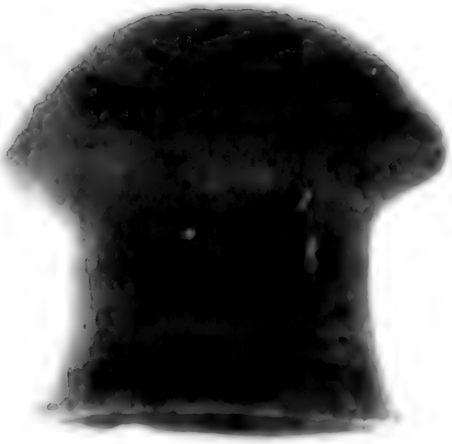

Fig. 61. Restored Trincheras specular Purple-on-red jar from Excavation Area 1. Side view.

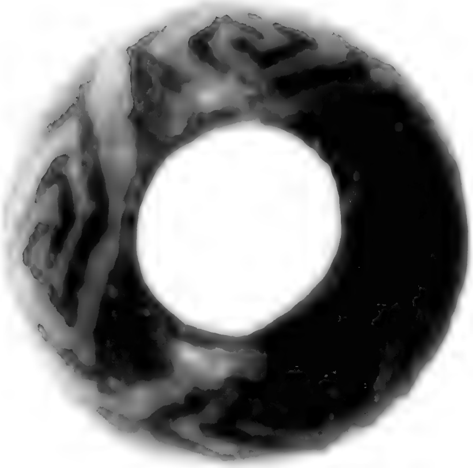

Fig. 62. Restored Trincheras specular Purple-on-red jar from Excavation Area 1. Top view.

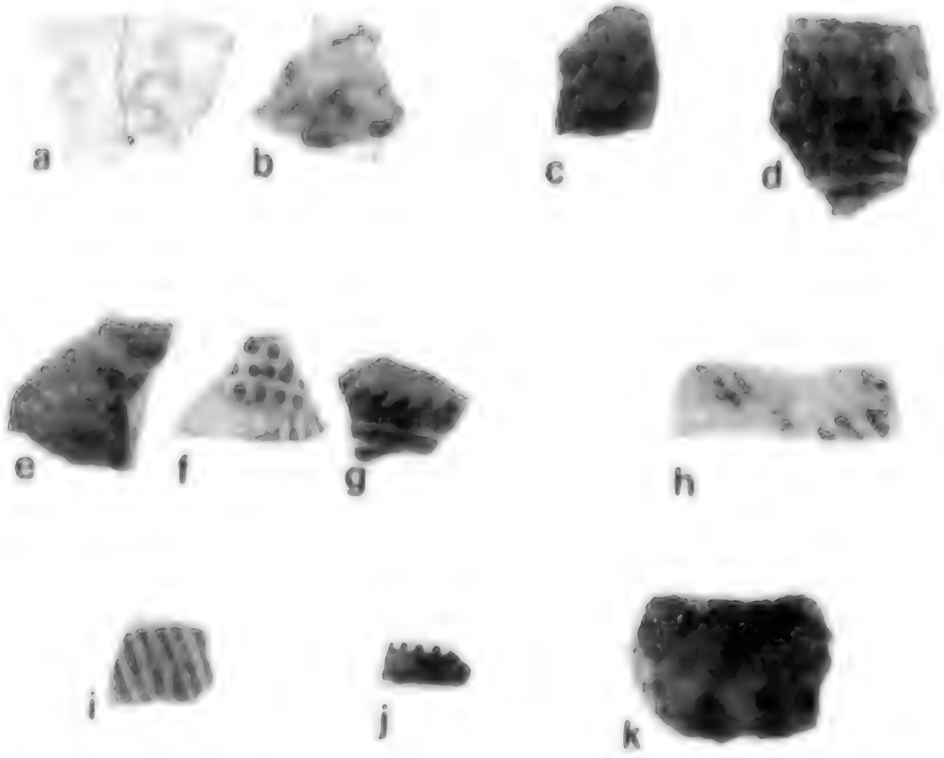

Fig. 63. Sherds presumed intrusive at [illegible]: (a-b) [illegible] Red-on-brown, (c) Trincheras specular Purple-on-red, (d) Trincheras non-specular Purple-on-red, (e) Rillito Red-on-brown, (f-g) Rincon Red-on-brown, (h) Sacaton Red decorated, (i) Deadman's Black-on-red, (j) Black Mesa Black-on-white, (k) Yuman(?) Stucco ware.

The function of this specimen needs to be briefly discussed. I have already indicated that this specimen would at the very least be a "curiosity piece" and probably was given some sort of non-secular overtones as well. In this beholder's eye the shape of the object suggests two things. First, it is possibly a phallic symbol, perhaps used for fertility or growth rituals. Phallic objects, while not common, nevertheless are present at many Hohokam sites. An equally speculative suggestion is that the Gu Achi vessel was purposefully designed in the shape of a mushroom. Mushrooms were used as an art form by various Mesoamerican groups, especially on what appear to be ceramic and stone pottery-making tools (De Borhegyi 1963). The reasons for this are not known but are probably related to the hallucinogenic properties of some types of mushrooms. At present there is no evidence that the Hohokam were involved in this Mesoamerican phenomenon, and the large opening at the top of the Gu Achi specimen rules out use as a pottery-making anvil. However, if manifestations similar to the Gu Achi specimen are eventually discovered in other southern Arizona sites, the Mesoamerican "mushroom" connection may well be worthy of further investigation.

Deadman's Black-on-red. A single small bowl sherd of Deadman's Black-on-red (Fig. 63i) was found on the surface of the trash mound (Locus G). This pottery type is from the San Juan Red Ware tradition of northeastern Arizona. The Gu Achi specimen is 0.3-0.4 cm thick and exhibits narrow parallel linework, both typical attributes of this pottery type (Colton 1965). Colton dates Deadman's Black-on-red around A.D. 750-1050 (1965), while Breternitz (1966) dates it between A.D. 775-1066. Both sets of dates agree with the Santa Cruz/Sacaton phase assessment of the trash mound. The presence of this Anasazi pottery type at Gu Achi is no surprise since Deadman's Black-on-red was one of the most popular decorated intrusives at Snaketown. Seventy sherds and one whole vessel were recovered from both field seasons there (Haury 1976: Fig. 16.1 "Deadmans Black/Wh." (sic.)).

Black Mesa Black-on-white. A single sherd of Black Mesa Black-on-white was also found on the trash mound surface (Locus G). This bowl sherd (Fig. 63j) is 0.4 cm thick and has a broad line of decoration with pendant dots. Black Mesa Black-on-white is a Tusayan White Ware manufactured by the

Anasazi in northeastern Arizona (Colton 1965). Breternitz (1966) tree-ring dates this type to between A.D. 875-1130, which again agrees with the associated Hohokam assemblage. Like Deadman's Black-on-red, White Mesa Black-on-white has been found in significant numbers at Snaketown (33 sherds and one whole vessel) (Haury 1976: Fig. 16.3).

Stucco ware. This is not a type name, but rather a descriptive term for several sherds from the same jar, one of which exhibits a thick coating of stucco (Fig. 63k). These specimens were recovered from the upper levels of Excavation Area 1. Macroscopically, stucco ware sherds have a temper composition similar to selected sherds of crushed altered andesite(?) that presumably were locally made. Petrographic analysis (Appendix G) suggests that while the stucco ware sherd may have the same temper source as some of the Gu Achi plainware, it is distinct enough to have been imported.

Stucco ware is uncommon at pre-Classic period Hohokam sites, except for those in the westernmost portion of the Papagueria and in the Gila Bend area. Michael R. Waters (1978: personal communication) has identified the Gu Achi specimens as a variant of Tumco Buff, a Lowland Patayan (Yuman) Buff Ware type dating between A.D. 1000-1500 (see also Waters in press).

Yuman. The final intrusive specimens found at Gu Achi are two sherds from one jar that exhibits possible affiliations with the Yuman (Lowland Patayan) culture area to the west. The sherds are hand-finished, tempered with fine sand, have a gray core with occasional flecks of carbonaceous material, and range between 0.6-0.7 cm in vessel wall thickness. The original vessel form appears to have been that of a jar (globular bodied (?) with an outflaring rim. Petrographic analysis (Appendix G) indicates some temper similarities between this specimen and the previously mentioned stucco ware.

This specimen seems to share some characteristics with Whetstone Plain ware (DiPeso 1953; Doyel 1977b; Masse in press c), a protohistoric and early historic plainware pottery associated with the Sobaipuri culture of southeastern Arizona.

Miscellaneous Worked and Eccentric Ceramics

Not included in the ceramic totals listed in Tables 8 and 9 are a number of worked sherds and eccentric ceramic objects. Such objects are common in Hohokam sites, but in most cases their functions are not known. The Gu Achi specimens are separated into three categories--sherd discs, eccentrics, and miscellaneous worked fragments. These are briefly discussed and are summarized in Tables 10 and 11.

Sherd Discs

As the name implies, sherd discs are generally circular sherds fashioned from fragments of ceramic vessels. Sherd discs can be made simply by chipping them to shape, but specimens often have margins that were additionally smoothed by grinding. Ten sherd discs from Gu Achi are chipped while 10 others show some grinding (Fig. 64). The chipped specimens range from 2.3 to 5.2 cm in diameter while the ground specimen diameters range from 2.1 to 5.4 cm. One large rectangular ground specimen has a length of 6.5 cm. All but one of the sherd discs are from fragments of jars. The chipped specimens are from schist- and altered andesitic(?) grus-tempered plainwares. The chipped and ground category is fashioned from decorated wares and the better made plainwares.

Only one of the 20 discs was found in association with a prehistoric occupation surface. The smallest chipped sherd disc (Fig. 64j) was found northwest of the ramada structure in Excavation Area 1. The other sherd discs were recovered from either the upper levels of excavation units or the site surface. One chipped and ground sherd disc of transitional Santa Cruz/Sacaton Red-on-buff (Fig. 64o) was found at the level of the occupation surface exposed by erosion in Locus Q. The association of the transitional Rillito/Rincon Red-on-brown chipped and ground sherd disc (Fig. 64t) with Locus Y may be the result of sheet flooding.

A biconically perforated sherd disc with chipped margin (Fig. 65b) was found on the occupation surface of Excavation Area 1 just east of the ramada. Such objects are commonly interpreted as spindle whorls, and its presence adds another possibility to the activities carried out in and around the ramada structure.

Eccentrics

Four "eccentric" ceramic objects were recovered from Gu Achi. Two of

			Provenience	Pottery Type	Dimensions (Diameter/Thickness)	Original vessel shape
Sherd discs	Unperforated	Chipped margins	Excavation Area 1	altered andesitic(?) grus	2.3 / 0.6-0.7 cm	jar
			Excavation Area 1	schist	3.9 / 0.7-0.9 cm	jar
			Excavation Area 1	schist	3.1 / 0.6 cm	jar(?)
			Excavation Area 3	altered andesitic(?) grus	2.6 / 0.7 cm	jar
			Excavation Area 4	altered andesitic(?) grus	2.4 / 0.5 cm	jar
			Excavation Area 4	schist	5.2 /0.7 cm	jar
			AC Quad	altered andesitic(?) grus	4.8 / 0.6-0.7 cm	jar
			AC Quad	altered andesitic(?) grus	4.5 / 0.6-0.7 cm	jar(?)
			AC Quad	schist	4.8 / 0.5-0.6 cm	jar(?)
			AC Quad	schist	4.7 / 0.3-0.4 cm	jar
		Chipped and ground margins	Excavation Area 1	schist	5.4-6.5 / 0.8 cm	jar
			Excavation Area 1	Gila Plain	4.8 / 0.6-0.7 cm	jar
			Excavation Area 2	Sacaton Red-on-buff	2.1 / 0.4-0.5 cm	?
			Excavation Area 4	altered andesitic(?) grus	4.2 / 1.0-1.2 cm	jar
			Locus Q	transitional Santa Cruz/ Sacaton Red-on-buff	3.7 / 0.5 cm	jar
			Locus Y	transitional Rillito/ Rincon Red-on-brown	5.4 / 0.7 cm	bowl
			AC Quad	altered andesitic(?) grus	4.2 / 1.0-1.2 cm	jar
			AC Quad	schist	3.5 / 0.9 cm	jar
			AC Quad	Gila Plain	3.0 / 0.6-0.7 cm	jar(?)
			Miscellaneous Surface	undecorated buffware	2.5-3.0 / 0.5-0.6 cm	jar
	Perforated		Excavation Area 1	schist	4.3 / 0.5 cm	jar
Ceramics	Rectangular		Excavation Area 14	schist	8.5 x 2.9 x 1.2 cm	jar
			Miscellaneous Surface	Rincon Red-on-brown	4.4 x 3.3* x 0.6 cm	bowl
	Elliptical		AC Quad	white schist	2.8* x 2.9 x 0.8 cm	jar(?)
	Miniature Bowl		Excavation Area 1	fine sand	height 1.3 cm diameter 3.0 cm wall thickness 0.2-0.6 cm	

*dimension incomplete because of fragmentary nature of specimen.

Table 10. Sherd discs and ceramic eccentrics.

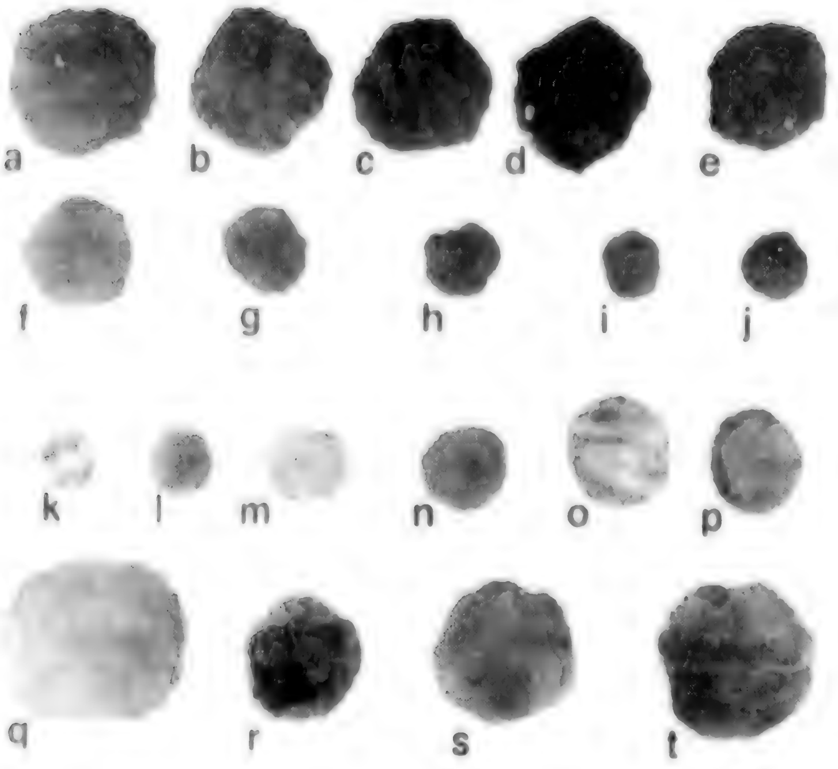

Fig. 64. Unperforated sherds discs: (a-j) chipped, (k-t) shaped with ground margins.

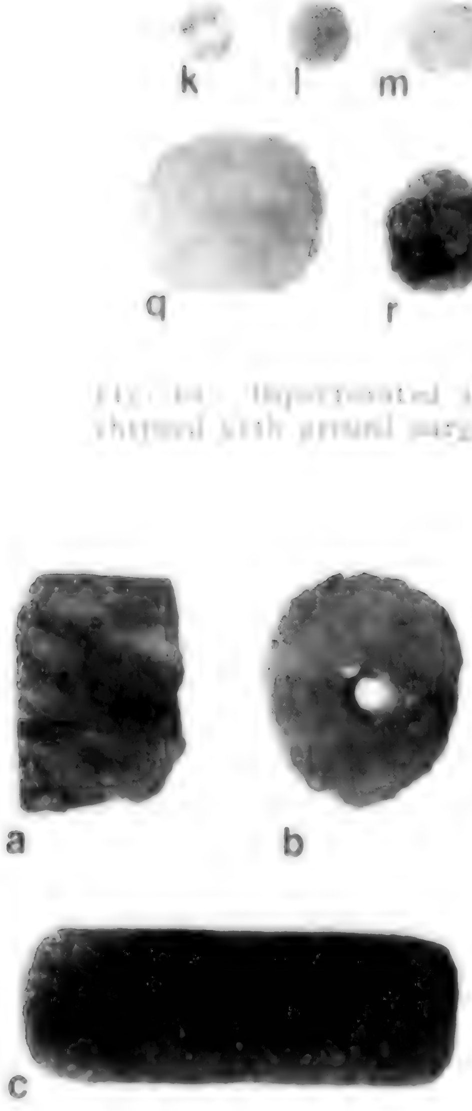

Fig. 65. Worked sherds: (a) Rincon Red-on-Brown sherd with ground margin, (b) perforated sherd disc, (c) shaped rectangular sherd from a large schist-tempered jar.

Fig. 66. Unusual ceramic objects: (a) miniature bowl, (b) foot from a red-on-buff effigy vessel.

these are rectangular worked sherds with well-ground margins. One, a complete specimen of schist-tempered plainware (Fig. 65c), was found in the fill of the Excavation Area 14 hearth. The other, a fragmentary eccentric of Rincon Red-on-brown, was found on the site surface (Fig. 65a). An ellipsoidal fragment with ground margins was picked up on the surface of the AC Quad. The function of these eccentric worked sherds is unknown.

The final eccentric specimen is a fragment of a miniature bowl (Fig. 66a) found just above the occupation surface in Excavation Area 1. It is tempered with fine sand (or perhaps lacks temper entirely), which, as Haury noted (1976: 268), is the temper used to make figurines. The dimensions of the bowl are just about the size achieved by squeezing one's thumb into a small lump of clay. Wall thickness ranges from 0.2-0.6 cm. The vessel has been lightly polished and was well fired. Haury (1976: 268) has dated similar miniature vessels at Snaketown to the Pioneer period and suggests that they may be somehow related to the figurine complex. The dating of the Gu Achi miniature bowl (Santa Cruz/Sacaton phase) and the absence of figurines at Gu Achi indicates that this specimen did not have the same purpose as those at Snaketown.

Miscellaneous Worked Fragments

Eleven sherds from Gu Achi have a portion of their margin ground. Many of these are, without doubt, the fragments of sherd discs either broken during use or during disc manufacture. Table 11 provides a summary of these specimens.

Petrographic Analysis

To date only three petrographic studies have been reported for Hohokam ceramic assemblages. One of these was Nora Gladwin's analysis of pre-Classic period specimens from Snaketown and selected Mogollon sites in New Mexico (1937), while the other two studies, Wallace's study of specimens from the University Indian Ruin in the Tucson Basin (1957) and Severa and Severson's (1978) analysis of ceramics from the Papago Reservation, deal primarily with Classic period materials. In addition, a recent study of the ceramics from a Yuman (Lowland Patayan) site in the Western Papagueria

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Provenience	Pottery Type	Comments
Excavation Area 1	schist	sherd disc fragment(?)
Excavation Area 2	undecorated buffware	found on lower occupation surface
Excavation Area 3	altered andesitic(?) grus	sherd disc fragment
	sand	discarded during disc manufacture
AC Quad	schist with sand	sherd disc fragment
	schist	sherd disc fragment
	crushed altered andesite(?)	sherd disc fragment
	crushed altered andesite(?)	not a sherd disc(?)
	crushed altered andesite(?)	not a sherd disc(?)
	schist	broken during disc manufacture(?)
BC Quad	schist	sherd disc fragment

Table 11. Summary of miscellaneous worked sherd fragments.

(Huckell 1979) has also been accomplished. These studies are by no means exhaustive, but provide interesting and potentially useful data concerning some aspects of Hohokam culture. For this reason, it was decided that petrographic analysis would benefit the study of Gu Achi.

Nineteen sherds from Gu Achi were subjected to petrographic analysis (Appendix G). These specimens were selected with two goals in mind. First, it was felt that petrographic analysis of the Gu Achi plainwares would greatly help set up meaningful plainware type categories. As already pointed out, the petrographic analysis did, in fact, permit the collapsing of the more than 40 initially defined "types" into the 13 types defined in this volume.

One of the interesting findings is that specimens whose appearance seems greatly different to the naked eye are quite similar petrographically. The most pronounced example is the distinction between crushed altered andesite(?) (Appendix G, specimens 2 and 4) and altered andesitic(?) grus (specimens 3 and 5). To the naked eye crushed altered andesite(?) generally appears as large, angular, purple platelets tightly packed together in the clay matrix. Occasionally these platelets are green or gray. Altered andesitic(?) grus, on the other hand, consists of small, subrounded grains that give a variegated appearance because of the alteration of a whitish component. The color of the altered andesite(?) occurs equally as either purple or gray, but both colors rarely occur together. Without petrographic analysis, a ceramic typologist could easily divide these specimens into five or six distinct types (as I initially did). However, petrographic analysis reduced these to the two stated types and further revealed that these two types have practically identical compositions and possibly were obtained from two different but close locations in the same deposit.

The second goal of the Gu Achi petrographic analysis was to determine whether the buffwares and specimens of Gila Plain were manufactured locally at Gu Achi or were being traded in from elsewhere, such as the Gila Basin. The importance of this study lies in the fact that large numbers of "core area-like" buffware and plainware ceramics have been reported from many non-core area (that is, outside the Gila and Salt River Valleys) sites in southern Arizona. If these ceramics represent imports from the core area, then it is likely that ties were continuously maintained between the Hohokam core area and the regional populations. Thus, quantification of locally produced versus imported pottery could be used to shed light on Hohokam interregional economic and social systems. To aid in this study, six sherds from three other Hohokam sites in southern Arizona were also subjected to petrographic analysis for comparison with the Gu Achi material. Six sherds are an extremely small sample, but I hoped that they would provide at least a few insights on the problem of the relationships between the Hohokam core area and regional populations.

In order to elicit such information, Dr. Loomis (Appendix G) was requested to compare specific combinations of specimens. His findings for each set of comparisons will now be briefly discussed. The reader is referred to Table 40 and section III of Dr. Loomis's report.

Specimens 1, 6, 7, 9, 20. This group was set up in order to compare various schist-tempered specimens and Gila Plain. It appears that the late Pioneer period potters at Gu Achi (Specimen 1) utilized the same schist sources as the Santa Cruz/Sacaton potters (Specimen 9). The major difference between these two is that the schist in the earlier specimen has been more finely pulverized. As noted earlier in this chapter, the white schist (Specimen 7) used in Sells phase pottery must likely came from sources around the parent villages (such as Ash Hill) rather than from the immediate vicinity of Gu Achi. Had the source of white schist been close to Gu Achi, it is likely that the pre-Classic Hohokam would have utilized white schist to at least some extent.

The specimen (6) of Gila Plain from Gu Achi could have been locally produced and is conceivably from the same source as the schist-tempered specimens. The sherd of Gila Plain from Alder Wash Ruin in the San Pedro Valley (Specimen 10) is roughly contemporaneous with the sherd from Gu Achi. The petrography of the Alder Wash Ruin specimen is fairly distinct from that of the Gu Achi specimens, as might be expected because of the large distance between the two sites. The small sample and the lack of study on source areas near the two sites makes it impossible to know if the sherds were locally made in their respective sites. However, it is suggested that at the very least these two specimens of Gila Plain were not manufactured at the same site, thus, perhaps, ruling out the possibility that they represent tradewares from a single large core area village (such as Snaketown).

Specimens 2, 3, 4, 5, 10. These five plainware specimens were compared because they occurred at Gu Achi in large quantities (except Specimen 10), and while exhibiting substantial differences in the physical appearance of the temper, these specimens shared properties such as purple temper. Specimens 3 and 5 (altered andesitic(?) grus) appeared to match the type description for Sells Plain (Scantling 1940), while Specimens 2 and 4 (crushed altered andesite(?)) seemed to be variants of Wingfield Plain (Weaver 1974). A fragment of the stucco ware jar (Specimen 10) was also included as it exhibited tempering material similar to the crushed altered andesite(?).

As previously mentioned, petrographic analysis indicated that altered andesitic(?) grus and crushed altered andesite(?) are so similar in composition that they are considered to be from the same source. The substantial quantities of altered andesitic(?) grus and crushed altered andesite(?), the presence of several vessels with diameters in excess of 70 cm, and the fact that these two types are from the same source combine to suggest that the two types were made locally at Gu Achi. The stucco ware, however, appears to be distinct from crushed altered andesite(?) and was probably "traded" into Gu Achi.

Specimens 9, 10. The stucco ware and the possible Yuman sherd were compared because it was believed that they were both part of the Lowland Patayan Buff Ware Ceramic Tradition (Waters in press). Petrographic analysis supports this contention in that neither sherd appears to have been made at Gu Achi. Yuman ceramic types exhibit a wide range of temper categories; thus, it is not surprising to find that Specimens 9 and 10 came from different source areas.

Specimens 11, 12. It was noted during the analysis of the Gu Achi buffwares that a small percentage contained larger amounts of rounded sand grains and less mica than normally expected. On the assumption that these "sandy" buffwares may have been of local manufacture, Specimen 11 ("sandy" Snaketown Red-on-buff) was compared to Specimen 12 ("micaceous" Snaketown Red-on-buff). Petrographic analysis demonstrated that the "sandy" buffware definitely had a lower muscovite content than Specimen 12. However, it could not be demonstrated petrographically that these two specimens were actually from different sources. Thus, in this particular case the question of origin remains unresolved.

Specimens 13, 14. For the same reason as described above, "sandy" transitional Santa Cruz/Sacaton Red-on-buff (Specimen 14) was compared to "micaceous" transitional Santa Cruz/Sacaton Red-on-buff (Specimen 13). These two specimens are texturally different, as can be seen in Figures 114 and 115. However, petrographically they are quite similar, possibly even being from the same source. Unfortunately, it was not possible to determine whether they were made locally or elsewhere (that is, the Gila Basin), though I suspect the latter.

Specimens 11, 12, 23, 24. This group was selected for comparison as it represents roughly contemporaneous (Snaketown/late Snaketown phase) specimens from three widely scattered regions of southern Arizona. Specimen 11 is somewhat distinct because of its low percentage of muscovite, but the other three sherds (one each from the three different regions) are petrographically indistinguishable.

Specimens 13, 14, 21, 22, 25. Like the previous category, this is a roughly contemporaneous (transitional Santa Cruz/Sacaton phase) group of buffwares selected from three different southern Arizona regions. I hoped that petrographic analysis would demonstrate these specimens to be from the same source (with the exception of Specimen 25), as might be expected because of the rapid increase in settlements and the beginning of nearly mass production of ceramics at Snaketown (Haury 1976: 194). Three of these specimens (13, 14, 21) are quite similar while Specimen 22 differs only in having a slightly lower muscovite content. Specimen 25 is from the Big Ditch Site in the lower San Pedro Valley (Masse n.d.a) and was used as a control because of obvious temper differences from other buffwares. Macroscopically, local Big Ditch buffwares contain copious amounts of large platelets of sericite phyllite. These platelets are further distinctive because of their gray color. Petrographic analysis did indeed show that Specimen 25 was distinct from the other buffwares, although the distinction was not as pronounced as expected.

Specimens 11, 12, 13, 14, 21, 22, 23, 24, 25. This comparison included all buffwares subjected to petrographic analysis and simply combined the observations noted above. It is obvious that with the exception of Specimen 25, all of the buffware sherds are nearly indistinguishable. On the basis of this admittedly small sample I suggest that most (and perhaps all but Specimen 25) of these buffwares were made in the same general region, presumably the Gila Basin. However, this hypothesis is extremely tentative and must be verified by more exhaustive petrographic analysis.

Specimens 16, 17. These two sherds of Tanque Verde Red-on-brown were analyzed in an attempt to see how they compared to specimens reported on by Wallace (1957) and Severa and Severson (1978). The Gu Achi sherds more closely resemble Papaguerian specimens than Tucson Basin specimens. Thus, it is likely that the Gu Achi specimens were manufactured at nearby Sells phase villages (such as Ash Hill).

Specimens 15, 16, 17, 18, 19. The final petrographic comparison was among four different decorated brownwares. Vamori Red-on brown (Specimen 15) was supposedly manufactured solely in the Papagueria, Rillito Red-on-brown (Specimen 18) in the Tucson Basin, Trincheras Purple-on-red in northern Sonora, and Tanque Verde Red-on-brown (Specimens 16, 17) in both the

Tucson Basin and the Papagueria. It was hoped that comparison of these specimens would show these assumed regional differences. Petrographic analysis indicated that all five specimens were basically similar; however, Specimens 15, 16, and 17 were judged to be quite similar, while Specimens 18 and 19 differed to varying degrees. This would tentatively suggest that Specimens 15, 16, and 17 were manufactured in the Papagueria, while 18 and 19 could have been made elsewhere (presumably the Tucson Basin and northern Sonora, respectively). Curiously, Loomis observed that Specimen 19 (Trincheras Purple-on-red) closely resembles Specimen 10 (Gila Plain from the northern San Pedro Valley) except for muscovite mica content. This once again reinforces the fact that similar clay and temper sources are present over a large portion of southern Arizona, limiting the interpretation of petrographic analysis. This problem will be alleviated, however, as more petrographic studies are undertaken and reported.

Lithics

The lithic artifacts obtained from Gu Achi form a small but significant portion of the site assemblage. One thousand sixty-eight pieces of stone were recovered during the excavation and survey program, including 1019 specimens of chipped stone tools and debitage, 30 pieces of ground stone, and 19 miscellaneous worked and unworked objects. The last category includes palettes, carved stone, ochre, beads, and several other items.

Chipped Stone

For the purpose of this report four categories of chipped stone are recognized. These include debitage, cores, core tools, and flake tools. Provenience and material type for these categories are given in Tables 13 and 14, respectively.

Debitage

Debitage refers to the waste flakes created during core reduction and tool-making activities. Such flakes represent 71% (723) of the total number of chipped stone pieces found at Gu Achi. Most pieces of debitage can be classified according to stages of reduction. Five such stages were recognized for the Gu Achi material: primary decortication, secondary decortication, flakes without cortex, biface thinning flakes, and chunks.

"Primary decortication" flakes are the first flakes to be removed from a cobble during core reduction. One side of such flakes retains the original cortex (unmodified outside surface) of the cobble. Only 46 primary decortication flakes were recovered from Gu Achi, 7% of all debitage collected). These were not concentrated in any one location at the site. Thus, it appears that most primary reduction was accomplished away from the site, possibly in nearby quarry areas. Quarry areas were not observed during the author's survey but can be expected because other quarry areas exist in the Papagueria (see Chapter 6). A burned quartzite core and an associated burned quartzite primary flake, found on the occupation surface in Excavation Area 1, indicate that at least some primary reduction was accomplished at the site.

"Secondary decortication" flakes retain some of the original cobble cortex on part of the flake; however, flake scars around cortical areas indicate that other flakes had been previously detached from the cobble/core. Secondary decortication flakes result from this further reduction of a core. They comprise the bulk of the debitage at Gu Achi (45%) and were found in most of the excavation units.

"Flakes without cortex" ("no cortex") refers to those flakes that show no signs of cortex. These can result from the flaking of cores that have been already greatly reduced or from the removal of small flakes from larger flakes during tool manufacture. Thirty percent of the debitage at Gu Achi had no cortex.

"Biface thinning" flakes are removed from a larger flake during production of a bifacial implement. Because of the way these flakes are removed, they have distinct characteristics, such as thinness, narrow, somewhat diverging sides, no cortex, and an occasional pronounced lip near the spot where the flake was struck ("platform"). No flakes of this type were positively identified at Gu Achi though two small obsidian flakes found above the occupation surface in Excavation Area 1 had some of these traits. For the purpose of this analysis, however, they were classified as flakes without cortex. The general absence of biface thinning flakes at Gu Achi does not necessarily imply that bifaces were not being produced at the site. Biface thinning flakes are usually quite small, and special techniques (such as flotation analysis and the use of window-mesh size screens) must be employed for recovery. Even the use of quarter-inch mesh screens will not usually recover most biface thinning flakes. However, other than projectile points, few bifacially retouched tools were found at the site. The lack of biface thinning flakes, then, may relate to scarcity of bifacial tools.

"Chunks" are fragments of flakes produced in the course of reduction activities. These are probably the result of the flake shattering in unexpected ways because of improper reduction techniques or physical imperfections in the stone itself. Chunks exhibit few, if any, of the typical characteristics of flakes, such as a bulb of percussion and striking platform (see Crabtree 1972, 1973 for a more complete discussion of flake characteristics). As can be seen in Table 12, chunks co-occur at Gu Achi with secondary decortication flakes and flakes with no cortex. This was expected. Chunks constituted 18% of the debitage at the site.

Twenty-five pieces of debitage, mainly secondary decortication and flakes without cortex, had margins that were damaged. These "edge-damaged" flakes can be distinguished from "utilized flakes" (discussed below) in that the damage is irregular and is often of recent origin. While some edge damage on flakes may have resulted from tool use, most edge damage is probably the result of accidental processes such as the crushing of a margin during the removal of the flake from its parent source, stepping on the flake, and damaging the flake during excavation.

Cores

Cores are cobbles from which flakes have been detached. In most cases it appears that the flakes were the desired commodity, and the cores themselves were simply the source and by-products of flake procurement. Seventy-six cores, over 7% of the chipped stone assemblage, were recovered at Gu Achi. Few of these came from the excavation units. Most were picked up from the surface of AC Quad. Most cores from the excavation units came from the upper levels, and only two specimens were associated with an occupation surface, both in Excavation Area 1. However, the excavation units were small and no definite interpretation can be offered.

Five types of cores were distinguished on the basis of the manner in which flakes had been detached. "Single platform" cores are those specimens in which flakes were removed in a single direction around a perimeter (striking plane) of the core (Fig. 67j-l). Eight of the cores (11%) were of this type. One of these specimens was the burned core found on the occupation surface of Excavation Area 1 (Fig. 67k).

Twelve "bifacial" cores (16% of the cores) were found at Gu Achi. These cores were formed by removing flakes in two different directions, from the same convergent striking plane (Fig. 67g-i). These specimens show none of the crushing or battering that would be present on a "chopper," a tool with the same morphology as a bifacial core.

"Multiple platform" cores are thus named because flakes have been detached in several different directions from more than one striking plane on the specimen (Fig. 67d-f). Thirteen such cores (17% of the cores) were collected at Gu Achi. In general, the diameters of these specimens were larger than other core types. A specimen of this type, recorded in Locus V, had a diameter greater than 15 cm.

Three examples (4% of all cores) of "globular cores" were found in surface contexts at Gu Achi. Globular cores are the product of the reduction of a core using several different striking planes. Flakes are driven from the core in several directions until it is no longer practical to remove any more flakes. These cores are generally small and globular in shape (Fig. 67a-c) and are sometimes referred to as "exhausted" cores.

The final category is core "chunks." Like flake chunks, core chunks are most likely the product of improper reduction techniques or flaws in the material. The presence of 40 core chunks (53% of all cores) at Gu Achi is not unusual for Hohokam site assemblages.

Most of the 44 loci at Gu Achi contained one or more cores. However, as most raw materials were not available at or near the site itself, much of or even most of the primary reduction activities probably occurred away from the site at quarry areas.

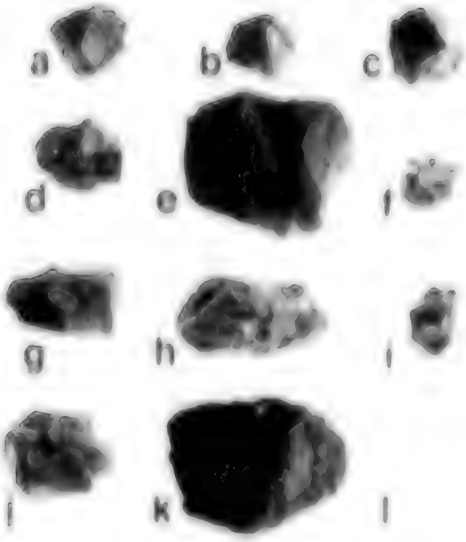

Fig. 67: Cores: (a-c) globular, (d-f) multiple platform, (g-i) converging platform, (j-l) single platform.

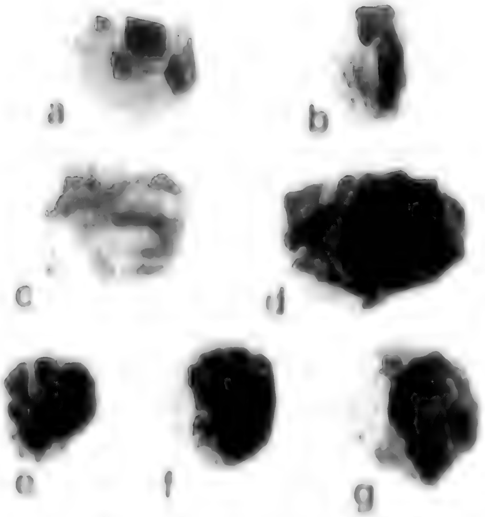

Fig. 68: Core tools: (a-d) scraper planes, (e-g) hammerstones.

Core Tools

Occasionally cores were used as tools. At least, we find tools that look as if they may have been fashioned from cores. It is often difficult to establish whether a core tool was manufactured from an actual core or whether the manufacturing process of a tool simply made it look as though it has come from a core. Nevertheless, 15 "core" tools were tentatively identified at Gu Achi, about 1% of the chipped stone retrieved from the site. These are grouped into three classes--core-hammerstones, core-scraper planes, and one core with a utilized margin.

Seven core-hammerstones were found at Gu Achi. These have moderately battered and crushed edges over much of each specimen (Fig. 68e-g). It is my belief that these were discarded (or "curated") cores that were later used for metate sharpening (see Haury 1976: 279) or similar activities. These core-hammerstones have several angular surfaces produced by earlier flake removal and are ideal for use as pecking stones. Five core-hammerstones came from multiple platform cores while the other two were bifacial

		Excavation Area 1	Excavation Area 2	Excavation Area 3	Excavation Area 4	Excavation Area 5	Excavation Area 6	Excavation Area 7	Excavation Area 8	Excavation Area 9	Excavation Area 11	Excavation Area 13	Excavation Area 14	Trench A	NE Quad	NW Quad	SE Quad	SW Quad	Locus A	Locus C	Locus D	Locus E	Locus I	Locus J	Locus O	Locus R	Locus S	Locus T	Locus W	Miscellaneous Surface	TOTAL
Debitage	Primary decortication	7	3	5	1	1	1								12		7	5												4	46
	Secondary decortication	51	23	32	13	10	2	3	10		1	1	1	3	97	2	47	18												11	325
	Without cortex	30	12	26	26	9	2	3	7			1		3	59		25	12												5	220
	Chunk	6	8	24	13	10		2	3		1			1	29	1	26	5												3	132
Cores	Single platform	2	1												2		2													1	8
	Bifacial	1			2									1	4		3													1	12
	Multiple platform		1												7		1													4	13
	Globular														2															1	3
	Chunk	4		3	3							2			22		1													5	40
Core tools	Hammerstone	1													1			2												3	7
	Scraper plane	1													2		1	1												2	7
	Utilized																	1													1
Flake tools	Projectile point	3			2														1	1	2	2	1	1	1		1	2	1	1	19
	Multipurpose	2			1										6		1	1													11
	Unifacial retouch	9	2	4	1	1								1	35	1	13	2												14	83
	Notched														3		1														4
	Perforator									1					3		2														6
	Utilized	8			2	1									24		13	2												2	52
	Chopper														1															2	3
	Tabular	5	2												12		4	2			1					1					27
	TOTAL	130	52	94	64	32	5	8	20	1	2	4	1	9	321	4	147	51	1	1	3	2	1	1	1	1	1	2	1	58	1019

Table 12. Chipped stone artifact types by provenience.

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PAGE

cores. Haury has suggested that such angular specimens were never cores but were manufactured specifically for metate sharpening or other purposes (Haury 1976: 279, Fig. 14.8a, b). Resolving the derivation of this tool type is not of critical importance; angular hammerstones seem related to metate sharpening. In the survey of the literature for preparing Chapter 6 of this volume, a strong co-occurrence of metates and hammerstones (usually undescribed) was noted at many sites.

Seven specimens of "core-scraper planes" were also recovered from Gu Achi. These have at least one flat surface (usually cortex), a portion of which exhibits steep retouch (greater than 65°-70°). Each of the specimens has several additional flake scars in various locations, suggesting that the tools are modified cores rather than previously unmodified cobbles (Fig. 68a-d). Five of the core-scraper planes appear to have been fashioned from multiple platform cores, one from a bifacial core, and one from a core chunk (though possibly from a multiple platform core).

The final core tool noted at Gu Achi is a small bifacial core with a utilized margin. This has very light crushing along 5 cm of the margin. Had this tool served as a chopper, the wear and damage to the margin should be much greater.

Flake Tools

Flake tools are tools manufactured from the flakes produced in core reduction. Primary decortication and secondary decortication flakes and flakes without cortex were all utilized in tool production; however, the majority of tools were manufactured from secondary decortication flakes. Few primary flakes were used.

A total of 205 flake tools was recovered from Gu Achi. These can be grouped into the following eight categories: projectile points, notched flakes, perforators, utilized flakes, unifacial retouch flakes, multipurpose flakes, tabular tools, and choppers. Even though many of these categories have functional names, these are not intended to imply a specific function. For example, perforators may or may not have been used to perforate objects. The use of these quasi-functional names simply follows a standard descriptive nomenclature used by most Southwestern archeologists.

Projectile points. Eighteen whole and fragmentary projectile points were found at Gu Achi, 13 on the site surface and five during excavation. In addition, an Archaic projectile point was recovered from a Sells phase site 1.5 km south of Gu Achi. These 19 projectile points can be grouped into eight discrete types that are described below. Six of the types, including all but two of the specimens, have been previously reported from Snaketown. The nomenclature for describing the Gu Achi specimens follows that outlined by Haury (1950: Fig 51). Table 13 summarizes the provenience and physical characteristics of these specimens.

Type 1: These elongated straight-sided triangular specimens have serrated edges along most of the length of the blade; the portion of the blade nearest the tip is not serrated. The bases of these points are usually straight, but one specimen (Fig. 69c) has a rudimentary notch. Four complete specimens recovered from the work at Gu Achi (Fig. 69a-d) are identical to specimens found at Snaketown in late Santa Cruz and Sacaton phase contexts (Gladwin and others 1937: Plate LXXXVC c, d). The Type 1 points at Gu Achi were likewise found in deposits of nearly pure late Santa Cruz/Sacaton phase contexts. A fragment of a projectile point (Fig. 69n) is possibly the unserrated upper portion of a blade from a large example of a Type 1 projectile point. Type 1 points longer then 6 cm were reported from Snaketown (Gladwin and others 1937: Plate LXXXC a, b).

Type 2: Type 2 projectile points are uniformly small (around 2.0 cm in length), the serrations extend nearly to the tip, and each exhibits a fairly well-defined basal notch (Fig. 69e-h). The tips of three of the four specimens are missing, possibly the result of impact shearing during use. The proveniences of the Gu Achi specimens are nearly pure late Santa Cruz/Sacaton phase deposits, correlating well with the dating of analogous specimens at Snaketown (Gladwin and others 1937: Plate LXXXV d-h).

Type 3: These triangular unserrated blades have wide lateral notches close to the base and well-defined basal notches (Figs. 69i-k). The tips of two of the three specimens have been somewhat crushed, probably by impaction. Each of these two is also missing a spar. The third specimen is missing its tip and a large portion of the upper part of the blade. The chronological placement of these specimens at Gu Achi and at Snaketown (Gladwin and others 1937: PLate LXXXVI) is in the late Santa Cruz/Sacaton phase.

Type 4: As with Type 3, the two Type 4 projectile points from Gu Achi have triangular blades with lateral notches close to the base. However, Type 4 is distinctive in that the edges of the blade are lightly serrated, the base is straight, and the notches are small (see Fig. 69l). Haury (1976: 298) has suggested that such small carefully worked notches may have been made with rodent teeth (see also Crabtree 1973: 28). These two projectile points are made from a high quality pale brown chert, as are similar specimens at Snaketown (Gladwin and others 1937: Plate LXXXVIII). Sources for this material type were probably not available in the Gu Achi area. Thus, either the raw materials or the projectile points themselves were imported. The dating of Type 4 specimens at Snaketown is either not well controlled, or the type had a relatively long life span. Examples from the early work at Snaketown (Gladwin and others 1937) date mainly to the Sacaton phase, while the more recent excavations show nearly even distribution from the Gila Butte through Sacaton phases. The two Gu Achi specimens come respectively from a late Santa Cruz/Sacaton phase locus, and a locus dating from the Gila Butte through Sacaton phase.

Type 5: A single fragment of what must have been a lengthy barbed projectile point was found in Locus D (Fig 69m). It appears to have been subjected to a cremation fire. While the original form of this specimen is not known, it was probably similar to Sacaton and Santa Cruz phase barbed projectile points reported from Snaketown (Gladwin and others 1937: Plates LXXXIX, XC).

Type 6: A distinctive basalt projectile point, designated Type 6, was recovered from late Snaketown/early Gila Butte phase trash in Locus F. The specimen has a slightly convex, lightly serrated blade, pronounced tangs and a short, narrow, rounded stem (Fig. 69o). Except for the light serration of its edges, this specimen is identical to Gila Butte phase examples at Snaketown (Gladwin and others 1937: Plate XCI i). A fragmentary Type 6 projectile point (Fig. 69p) may have been damaged by impact or could have been broken in manufacture.

Type 7: A somewhat unusual projectile point was found on the occupation surface of Excavation Area 1 (Fig. 69q). This obsidian point has a small triangular blade with wide corner notches and a stem that is more or less straight. In an apparent attempt to reduce the thickness of the point a large flake was struck off near the tip. This flake ended in a step fracture that has not been removed. In general, the chipping on this specimen appears to have been crudely executed.

The dating of the Type 7 projectile point is problematic. It is possible that this is a crude example of roughly similar examples of Sacaton phase age reported from Snaketown (Gladwin and others 1937: Plate LXXXVI c). However, because of the presence of light patination on this specimen and the absence of patination on other pieces of worked obsidian at Gu Achi, the Type 7 projectile point is probably Archaic in age. Haury illustrates a similar specimen from Ventana Cave that he suggests may date to the Amargosa II (Chiricahua stage of the Cochise culture) period (Haury and others 1950: Fig. 64b). There is no sign of recent flake scars (post-patination) on the Gu Achi point; thus, although it was found on a late Santa Cruz/Sacaton occupation surface, the Hohokam do not appear to have re-used it.

Type 8: An Archaic projectile point made from basalt was collected from the surface of a Sells phase site approximately 1.5 km west of Locus OO. The provenience of this point, on top of what appeared to be a substantial Sells phase trash deposit, suggests that the point was originally picked up elsewhere and brought to the site by a Sells phase occupant of the site. Type 8 is a small, leaf-shaped specimen pointed at both ends. There is a hint of a stem, but the "tangs" are so rounded as to give the point its leaf-like shape. Most closely analogous to this specimen are two point styles of uncertain temporal provenance from Ventana Cave (Haury and others 1950: Figs. 52h, 53b).

Notched flakes. Notched flakes have a steeply retouched notch along one or more of the flakes margins. Notches are found on the margin of a flat surface of thick flakes, and the notch itself is steeply retouched (greater than 65°). Four such tools were found at Gu Achi (Fig. 70), each with a single notch. Three were fashioned from secondary decortication flakes, the other from a flake without cortex. The notches average about 1 cm in length, with the concavity about 0.3 cm deep from the margin of the flake. Two of the notched flakes are very thick (greater than 1 cm), one is moderately thick (slightly less than 1 cm), and the last one is less than 0.5 cm thick.

		Provenience	Material	Condition	Dimensions*
Type 1	(Fig. 69a)	Excavation Area 4 18-24"	chalcedony	whole	4.0 cm x 1.2 cm x 0.4 cm
	(Fig. 69b)	Excavation Area 1 0-12"	chalcedony	whole	3.2 cm x 1.1 cm x 0.4 cm
	(Fig. 69c)	Excavation Area 1 0-20"	chalcedony	whole	2.7 cm x 0.9 cm x 0.3 cm
	(Fig. 69d)	Locus J surface	chalcedony	whole	1.8 cm x 0.8 cm x 0.3 cm
	(Fig. 69n)	Locus A surface	chalcedony	fragmentary	2.1+ cm x 0.9+ cm x 0.3+ cm
Type 2	(Fig. 69e)	Locus C surface	chalcedony	tip missing	2.0+ cm x 1.2 cm x 0.2 cm
	(Fig. 69f)	Excavation Area 4 18-24"	chalcedony	tip missing, tang missing	1.9+ cm x 1.0+ cm x 0.3 cm
	(Fig. 69g)	Locus V surface	chert	tang missing	1.8 cm x 1.0+ cm x 0.3 cm
	(Fig. 69h)	Locus Q surface	chalcedony	tip missing	2.1+ cm x 1.1 cm x 0.3 cm
Type 3	(Fig. 69i)	Locus I surface	chalcedony	tip missing	2.8+ cm x 1.3 cm x 0.3 cm
	(Fig. 69j)	near Locus V surface	obsidian	spur missing; tip impacted	2.7 cm x 0.9+ cm x 0.4 cm
	(Fig. 69k)	Locus E surface	obsidian	spur missing; tip impacted	2.1 cm x 1.1+ cm x 0.3 cm
Type 4	(Fig. 69l)	Locus U surface	chert	whole	3.1 cm x 1.3 cm x 0.3 cm
	(not illus.)	Locus RR surface	chert	tip impacted	2.5 cm x 1.2 cm x 0.3 cm
Type 5	(Fig. 69m)	Locus D surface (collection area 7)	chalcedony	fragmentary	1.6+ cm x 1.4+ cm x 0.4+ cm
Type 6	(Fig. 69o)	Locus D surface (collection area 5)	basalt	whole	3.3 cm x 1.6 cm x 0.4 cm
	(Fig. 69p)	Locus E surface	basalt	fragmentary	2.4+ cm x 1.3+ cm x 0.3+ cm
Type 7	(Fig. 69q)	Excavation Area 1 occupation surface	obsidian	whole	2.9 cm x 1.8 cm x 0.6 cm
Type 8	(not illus.)	1.5 km west of Locus OO	basalt	whole	4.4 cm x 2.0 cm x 0.7 cm

*Dimensions are listed as maximum length, width, and thickness, respectively. "+" indicates that the maximum dimension was not measureable because of the fragmentary nature of the specimen.

Table 15. Projectile point summary.

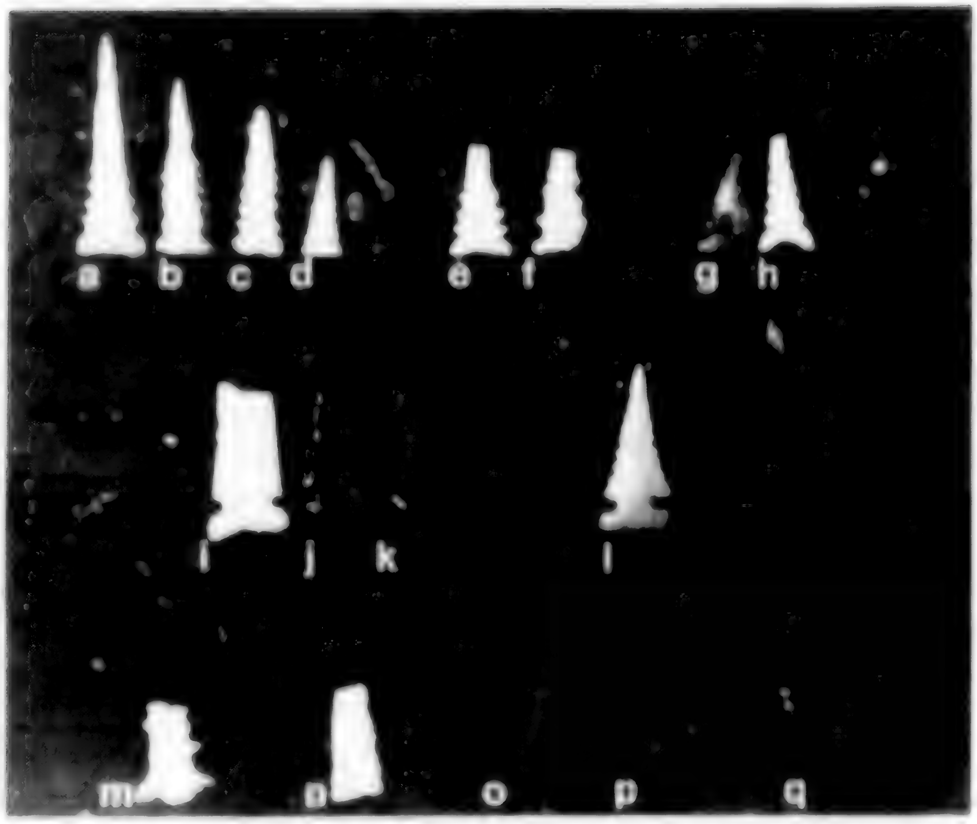

Fig. 69. Projectile points: (a-d, m) Type 1, (e-h) Type 2, (i-k) Type 3, (l) Type 4, (n) Type 5, (o-p) Type 6, (q) Type 7.

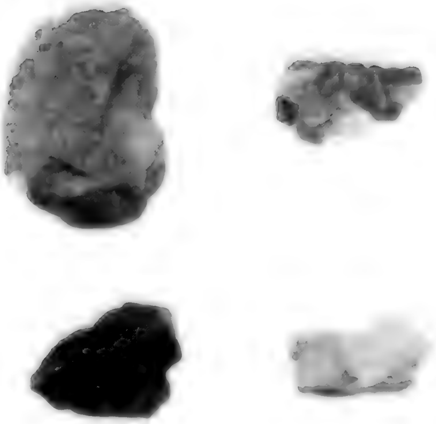

Fig. 70. Notched tools.

Fig. 71. Perforators.

The four specimens were all recovered from surface proveniences; thus, a functional interpretation cannot be made. The steep edge angle, however, suggests activities like wood working (arrow shaft scraping?) or, possibly, the shredding of fibrous materials such as yucca leaves.

Perforators. Six perforators (Fig. 71) were found at Gu Achi. One or more retouch flakes have been removed from these flake tools in a manner that produced a distinct point along one or more of the margins of flake. Such tools are also referred to as "gravers". The six specimens all have a single projection, the tip of which appears to have been slightly crushed by use. Four of these tools were made from secondary decortication flakes while the other two were from flakes without cortex.

None of the perforator projections was created by bifacial retouch. In fact, carefully executed, bifacially retouched "drills" were not found at Gu Achi, unlike most other sizeable Hohokam settlements (Kelly 1978: 80; DiPeso 1956: Plate 132, 134; Masse in press c). Surprisingly, drills were not found at Snaketown in either of the two excavation programs (Haury 1976: 298). Ventana Cave contained several drills, but it is not known how many are actually derived from the Hohokam occupation of the rockshelter (Haury and others 1950: 301-303). Snaketown and Ventana Cave, however, both contained sizeable numbers of perforators ("gravers") like those at Gu Achi.

Utilized flakes. Utilized flakes (Fig. 72) are the second most numerous type of flake tool found at the site. Fifty-two specimens, 25% of the flake tools and 5% of all chipped stone specimens, were recovered. Three were discovered on the occupation surface of Excavation Area 1. The remainder came mainly from surface contexts. Four of the utilized flakes were primary flakes, and eleven were flakes with no cortex while the remaining 37 flakes retained some original cortical surface of the parent cobble.

Three types of utilized flakes were distinguished in the analysis. The first of these is "use retouch". Flakes with use retouch have margins with irregular flake scars that resulted from use of the tool rather than from purposeful retouch. Fourteen flakes with use retouch were recorded. "Nibbling and crushing" refers to flakes the margins of which have sections that have been snapped and flattened (crushed) and/or that exhibit numerous tiny flake scars (nibbling). Thirty-seven flakes had nibbled and crushed margins.

Only a single specimen exhibited "use polish." The margin of the utilized flake with use polish was rounded, and its surface polished. Often on such specimens the direction of use will be defined by numerous striae; unfortunately, the Gu Achi specimen had no striae. Use polish is believed to be caused by use of the flake on a pliant object such as yucca or wood.

In recent years replication studies have shown that some types of activities (such as animal butchering) will leave no tell-tale evidence on flakes (Huckell in press), at least without detailed microscopic examination (see also Bryant and Bayham 1976). Thus, flakes that are considered debitage may in fact be tools. There is no way presently to resolve this problem other than to note that the number of flakes considered here as "utilized" are in fact an unknown sample of all flakes that may have actually been used in various activities at Gu Achi.

Unifacial retouch. Eighty-three flakes exhibited unifacial retouch, the largest category of the flake tools from Gu Achi. This number is 40% of the flake tools and 8% of all chipped stone at the site. Although there were large numbers of unifacial retouch flakes in Excavation Area 1, only one was associated with the occupation surface. All other specimens with unifacial retouch at Gu Achi were found on the site surface or in non-meaningful contexts in the excavation units.

Unifacial retouch refers to the purposeful, unidirectional removal (retouch) of small flakes from a larger flake in order to create a tool of desired shape and effect. Eight primary decortication flakes, 56 secondary decortication flakes, and 19 flakes with no cortex were unifacially retouched (Fig. 73).

Only nine specimens had somewhat evenly spaced and carefully executed retouch. One of these (Fig. 73a) was the only formal unifacial retouch tool recorded. This chalcedony specimen had pressure retouch along two margins that converged to a point with a broken tip. It may be a drill. The other specimens at Gu Achi had retouch that consisted of uneven flake scars that produce a somewhat jagged-looking flake margin. On most flakes the retouch flake scars were more or less continuous along the margin. A few flakes (12) had discontinuous retouch on more than one margin. In the latter cases usually no more than one or two flakes were taken from each margin, and these may result from use rather than purposeful unifacial retouch.

Edge angle was estimated for all unifacial retouch specimens. Six of the specimens had retouch with an edge angle less than 45°, 17 had an edge angle between 45-60°, and 38 had edge angles greater than 60°. The remaining specimen had two margins of retouch, one about 45° and the other 60°. The fairly steep edge angles of this assemblage suggest scraping activities. Flakes with acute edge angles (less than 45-50°) are generally considered to represent cutting functions and may be expected in sites where hunting played a major economic role. The Gu Achi assemblage is more typical of sedentary village sites. It should be noted, however, that no attempt was made to measure the edge angle of utilized flakes; many of these could conceivably have been for activities requiring flake margins with acute edge angles. Also, some studies have indicated that edge angles may not always be a critical factor in tool function, especially for coarse-grained materials (Wyant and Bayham 1976: 241).

No bifacially retouched tools other than projectile points and tabular schist knives were found at Gu Achi. Such a situation may suggest a heavy reliance on agriculture and gathering as opposed to hunting. However, with our imperfect understanding of Hohokam chipped stone tool functions this suggestion is only speculative. At Snaketown, both "scrapers" and "knives" were poorly represented (Haury 1976: 296).

Multipurpose. Multipurpose flake tools appear to have been utilized for more than one function (Fig. 74). Eleven identifiable specimens, 5% of all flake tools, were recovered. Five different combinations were noted. Four of these are utilized + perforator, three are utilized + unifacial retouch, two are unifacial retouch + perforator, one is utilized + notched, and one is notched + perforator. Eight of these tools have utilized margins. These tools may not have been originally designed as multipurpose tools; rather, during a tool's primary use (not the utilized margin), the need arose for the use of a another margin.

Multipurpose tools were not associated with any of the excavated prehistoric occupation surfaces at Gu Achi.

Tabular tools. Tabular tools form an important part of the Gu Achi chipped stone assemblage. Only 17 tabular tools (1%) of the chipped stone

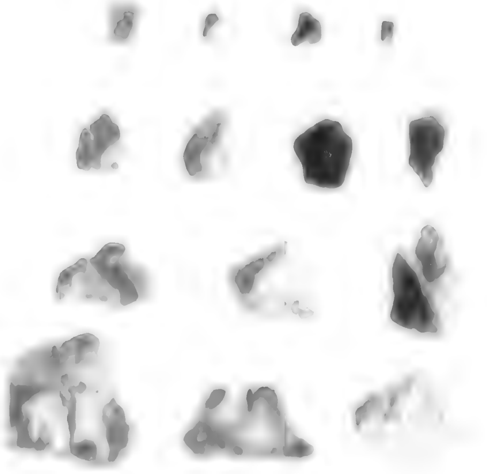

Fig. 72. Utilized flakes.

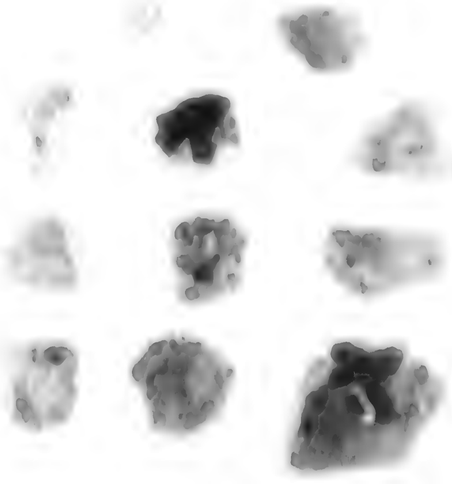

Fig. 73. Unifacially retouched flakes.

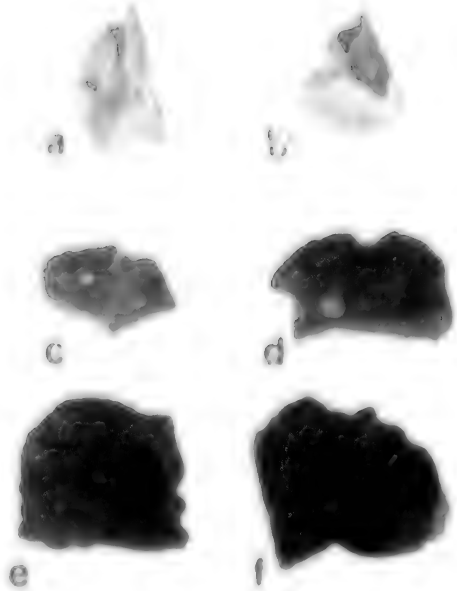

Fig. 74. Multi-purpose tools: (a-b, d) perforator/utilized margin, (c) notched/utilized margin, (e) unifacial retouch/utilized margin, (f) perforator/unifacial retouch.

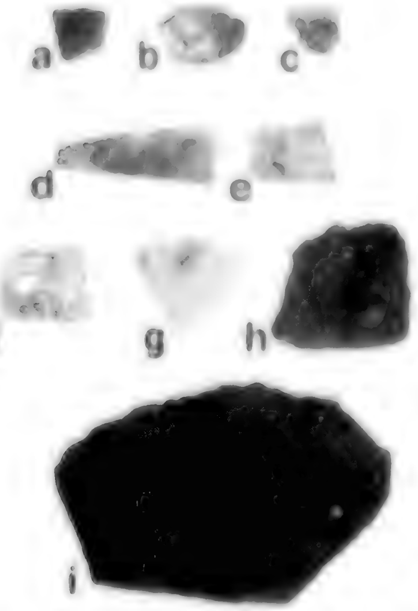

Fig. 75. Tabular tools: (a-c, g) knives, (d-f, h) scrapers, (i) "mescal" knife.

tool assemblage) were identified in the Gu Achi site collection. However, because of the physical properties of tabular tools, there is reason to believe that this tool type is greatly underrepresented. Most tabular tools at Gu Achi are made from schist or schistose material. Schist tends to be soft and friable and can be easily damaged. In this analysis, a tabular specimen was not considered a tool unless it exhibited convincing flake scars or ground surfaces. Thus, scores of tabular schist pieces were not classified as tools, and I suspect that many if not most of these were used as tools by the prehistoric people at Gu Achi.

The tabular tools were roughly sorted into three basic types, "knives," "scrapers," and "unknown." Tabular pieces of which the worked margins had an edge angle less than 45° were considered knives. Seven such knives are depicted in Figure 75 and illustrate the range of specimens at Gu Achi. One of these (Fig. 75g) exhibits well-executed bifacial grinding and is the only collected example that does so. This piece is fragmentary and probably came from a much larger tool. While it is the only ground specimen collected, many others were noted in the survey, including several large specimens of tabular knives that have been variously labeled in the literature as "mescal" knives or "stone hoes" (see Haury 1945: 134-136). The specimen in Figure 75i, found on the surface just south of Locus F, is typical of most of the large tabular knives noted in the survey. It is not ground but is flaked to produce a convex margin with an edge angle of 35°.

"Tabular scraper" was the term given to tabular specimens having flaked margins with an edge angle greater than 60°. Two of these are shown in Figure 75d, f. On both specimens the working edges have been dulled from use. The remainder of the Gu Achi tabular tools were not classifiable because of their fragmentary and weathered condition and because their edge angles ranged between 45-60°. Each of these specimens appeared to have been flaked and the majority were unifacially worked.

Choppers. Three chipped stone tools were designated "choppers" (Fig. 76). These have somewhat irregular bifacial flaking around a large portion of the specimen. In all cases the flaked margin had been lightly battered and dulled through use. Two of the specimens were manufactured from small discoidal cobbles while the other was fashioned from a thick tabular-like

		Green quartzite	Other quartzite	Chalcedony	Chert	Jasper	Quartz	Rhyolite	Basalt	Vesicular Basalt	Unknown igneous	Obsidian	Limestone	Siltstone	Schist	Slate	TOTALS
Debitage	Primary decortication	29	6	1				2	5				2	1			46
	Secondary decortication	217	33	7	6			13	35	1		8	3		1	1	325
	Without cortex	158	19	7	6	1	2	3	10			11	3				220
	Chunks	81	14	1			6	7	10			2	9		2		132
Cores	Single platform	3	1				1	1					1	1			8
	Bifacial	12															12
	Multiple platform	6	3					3		1							13
	Globular	3															3
	Chunks	26	2				1	3	5		1		2				40
Core tools	Hammerstones	6	1														7
	Scraper plane	6	1														7
	Utilized	1															1
	Projectile points			10	3				3			3					19
	Multipurpose	10							1								11
Flake tools	Unifacial retouch	65	2	5	1	1		2	5	1	1						83
	Notched	3							1								4
	Perforator	4		2													6
	Utilized	41	1	1				1	4			4					52
	Chopper	2						1									3
	Tabular	4							2						21		27
	TOTAL	677	83	34	16	2	10	36	81	3	2	28	20	2	24	1	1019

Table 14. Chipped stone types by material.

chunk of green quartzite. The lightly battered surfaces may have resulted from brief use as a hammerstone.

Chipped Stone Material Types

Thus far little has been said about the materials from which the Gu Achi chipped stone specimens were made. This information is summarized in Table 14. Several interesting patterns emerge from this data. First, green quartzite was the principal source material, constituting 66% of the entire chipped stone assemblage. In fact, when the other colors of quartzite (gray, rose, brown, white) are added to this total, quartzite comprises 75% of all the chipped stone. Igneous stone (including basalt, rhyolite, and obsidian) made up less than 15% of the chipped stone assemblage. This is somewhat surprising because there are abundant sources for most common igneous rock types in the region near Gu Achi. Haury noted that in Ventana Cave a full 75% of the more than 11,000 pieces of chipped stone from the midden were basalt (Haury and others 1950: 206). However, the midden includes both Archaic and ceramic-period culture horizons, and the high percentage of igneous materials could be the product of greater use of the rockshelter during the Archaic period when igneous stone was the preferred material.

No source for the green quartzite was located in the survey around Gu Achi. In an attempt to track down the source of this material, a check was made on Arizona State Museum collections from Ventana Cave and from Ash Hill, the Sells phase village two miles east of Gu Achi. Only a handful of the Ventana Cave specimens (less than 1%) were manufactured from green quartzite, but a much higher percentage of green quartzite was found at Ash Hill. This strongly implies that the source of the green quartzite is near Gu Achi and Ash Hill though further removed from Ventana Cave. A possible source may be the Brownlee Mountains just south of Gu Achi, that, according to geologic maps, contain outcrops of quartzite.

At Gu Achi green quartzite was used for at least the mode and nearly always the majority of each chipped stone category, with the exception of two. These two are "tabular tools," for which schist was most often used, and projectile points. No projectile points were made from quartzite. This suggests either that green quartzite did not have properties necessary to

		Provenience	Material	Description
Metate	Trough	Excavation Area 2	rhyolite	1/3 - 1/2 complete (Fig. 77)
	Basin	AC Quad	vesicular basalt	fragment
		Exc.vation Area 13	vesicular basalt	small fragment
	Slab	Excavation Area 2	vesicular basalt	small fragment
		Miscellaneous Surface	vesicular basalt	small fragment
		Excavation Area 1	rhyolite	small fragment
	Unknown	Excavation Area 3	vesicular basalt	small fragment
Mano	Rectangular	Excavation Area 1	vesicular basalt	whole 16.6 x 9.2 x 3.7 cm (Fig. 78b)
	(bifacial)	Excavation Area 1	sandstone	fragment; converging grinding surfaces
		Excavation Area 2	vesicular basalt	1/2 complete (Fig. 78d)
		Excavation Area 12	granite(?)	whole 14.7 x 9.6 x 4.4 cm (Fig. 78a)
		AC Quad	vesicular basalt	fragment
		AC Quad	vesicular basalt	small fragment
		BC Quad	vesicular basalt	1/2 complete; converging grinding surfaces (Fig. 78c)
		Miscellaneous Surface	vesicular basalt	small fragment
		Miscellaneous Surface	vesicular basalt	small fragment
	Discoid	Excavation Area 1	granite(?)	fragment; bifacial
Handstone		Excavation Area 1	vesicular basalt	3/4 complete; unifacial; burned; flaked
	Ovoid	AC quad	rhyolite	nearly whole; bifacial (Fig. 78e)
		Miscellaneous Surface	quartz	fragment; bifacial
	Pestle	Excavation Area 1	rhyolite	whole 27.8 x 7.6 cm (Fig. 79a)
		Excavation Area 1	quartz(?)	whole 14.6 x 10.8 cm (Fig. 79b)
Hammerstone		Excavation Area 1	basalt	whole 7.8 x 8.2 cm (Fig. 80e)
		Excavation Area 1	gneiss(?)	whole 6.7 x 7.3 cm (Fig. 80c)
		Excavation Area 1	basalt	whole 5.0 x 6.7 cm
	Globular	AC Quad	quartzite	whole 5.6 x 8.0 cm (Fig. 80a)
		BC Quad	quartzite	whole 6.9 x 8.9 cm (Fig. 80d)
		BC Quad	quartzite	whole 4.3 x 6.6 cm
		Miscellaneous Surface	limestone	whole 6.7 x 8.6 cm (Fig. 80b)
	Elongate	Excavation Area 1	diorite(?)	whole 4.6 x 15.1 cm (Fig. 79c)

Table 15. Ground stone summary.

make a Hohokam projectile point, or that the Gu Achi inhabitants had a preference for certain materials for projectile point manufacture.

Samples of green quartzite were given to Bruce B. Huckell of the Arizona State Museum for knapping. He demonstrated that while occasional flakes of green quartzite are roughly suitable for the manufacture of some types of Hohokam projectile points, numerous tiny flaws in the material make fine pressure retouch difficult. Such evidence seems to indicate that the Gu Achi inhabitants chose not to make their projectile points from green quartzite because of either the local availability of more suitable raw materials or the importation of finished projectile points. Crabtree has suggested that the Hohokam may have preferred specific materials for specific point styles (1973: 12), a hypothesis that is in keeping with the Gu Achi data. Also, if projectile point manufacture was a craft specialty during the Hohokam Colonial and Sedentary periods as Crabtree (1973: 51-52) and Haury (1976: 297) suggest, then it is possible that projectile points simply were made in limited numbers or not at all at many sites outside the Hohokam core area and were obtained only through trade. The material types and technology of the Gu Achi projectile points are identical to those from Snaketown. The absence of chalcedony, chert, and obsidian cores at Gu Achi also lends some support to this thesis, though a moderate amount of debitage from these material types was recovered.

No nearby source is known for the siliceous material types or for obsidian (the latter apparently derived from "Apache tears"), materials of low frequencies at Gu Achi. These types could have been traded easily to the site occupants, rather than the Gu Achi Hohokam finding these materials and bringing the stone back to the site themselves.

Ground and Pecked Stone

Only 30 pieces of ground and pecked stone were recovered from Gu Achi (Table 16). These include milling equipment (metates, manos, handstones), pestles, and hammerstones. Mortars were not located at Gu Achi, except for one isolated specimen found north of the reservoir (Locus A) during survey. The paucity of ground stone may be due to the limited excavation of Gu Achi.

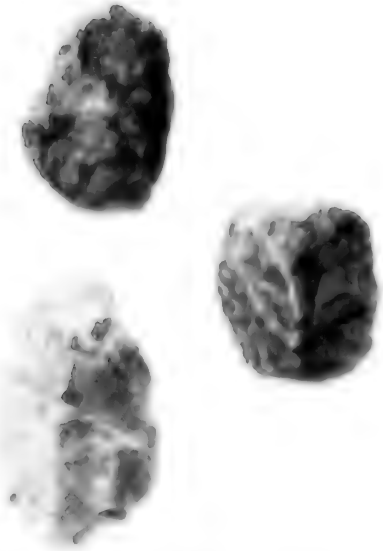

Fig. 76. Chopping tools.

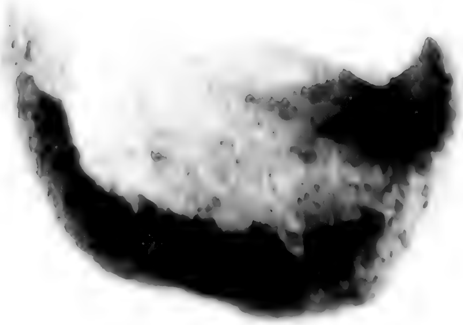

Fig. 77. Fragmentary trough metate from Excavation Area 1.

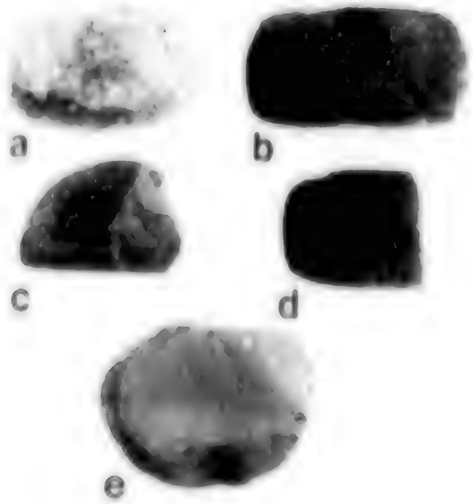

Fig. 78. Manos and handstones: (a-b), shaped rectangular unifacial manos, (c-d) shaped rectangular bifacial mano fragments, (e) unshaped bifacial handstone also used as a hammerstone.

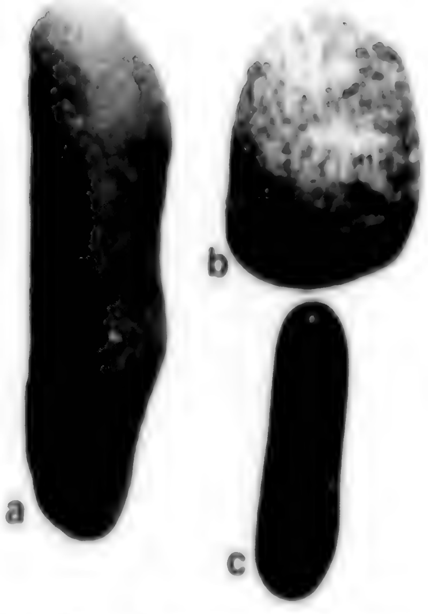

Fig. 79. Pestles (a-b) and elongated hammerstone (c) from Excavation Area 1.

However, even large villages such as Snaketown sometimes contain few specimens of certain categories of ground stone (Haury 1976: 280, 282). Items such as manos and metates, especially those of vesicular basalt, were recycled as hearth stones (Haury 1976: 280; Masse in press c). To see how many hearth stones at Gu Achi were recycled ground stone, a careful check of hundreds of hearth stones was made during the survey. Very few specimens of ground stone were found, which seems to demonstrate that the local availability of vesicular basalt from nearby locations, such as the Black Hills, made it generally unnecessary to recycle ground stone.

Metates

Seven metate fragments were collected from Gu Achi. Five of them are quite small, and the sixth is nearly one-half of a metate. The large specimen was from an open-ended trough metate, while the small fragments were from basin metates (2), slab metates (3), and one of unknown type. Two metates, found in Excavation Areas 1 and 3, could not be located in the Gu Achi site collections. One of these was a sizeable trough metate (Fig. 18), probably made from rhyolite; the other was of unknown type. Several other trough metates were noted in the survey, especially in Sells phase contexts. It seems certain that trough metates were used throughout the occupation of Gu Achi.

The metate assemblage at Gu Achi contains more slab and basin metates than the total from both field seasons at Snaketown. In fact, combined numbers of basin and slab metates at Gu Achi roughly equal the trough metate numbers during the pre-Classic period occupation of the site. At Snaketown troughs were the nearly exclusive metate type. This may represent some difference in subsistence practices between the two regional Hohokam populations and lend some credence to Haury's distinction between the "Riverine Branch" and "Desert Branch" Hohokam (Haury and others 1950: 517-518, 546-548; Haury 1976: 282).

Manos

"Manos" are distinguished from "handstones" in that the former are carefully shaped and are nearly always rectangular while the latter are unshaped round or oval cobbles. Ten whole and fragmentary manos were retrieved from Gu Achi, nine of which are of the shaped rectangular variety. The other is a somewhat unusual discoidal shape. Most of the manos are blockish in appearance, show bifacial use, and are indistinguishable from specimens at other Hohokam sites.

One complete specimen was found on the occupation surface inside the burned ramada of Excavation Area 1 (Fig. 78b), and a fragmentary mano (Fig. 78d) was found in association with Hearth 1 in Excavation Area 2. The second specimen is not burned. One of the other manos is discoidal, and two others have unusual grinding surfaces. The discoidal mano is a corner fragment. Because of its small size, it could be from a rectangular mano with a considerable convexity at the ends. The other two mano specimens have grinding surfaces that are not parallel but convergent. One of these, a sandstone fragment, has use surfaces that converge at the relatively low angle of 23°. The second mano, made from vesicular basalt, has a convergence angle of more than 60° (Fig. 78c). In effect, the two grinding faces on this bifacial specimen are the bottom and one side, rather than the top and the bottom. In addition, this specimen appears to have been used as a hearth stone, one of only a few such examples at Gu Achi.

Handstones

Handstones are cobbles that have not been modified except through the process of grinding. Three handstones were recovered from Gu Achi. One of these had been subjected to very light use on a single side. This specimen was found on the occupation surface of Excavation Area 1, near the storage jars south of the ramada. The other two handstones had bifacial wear. One of these had also been used as a hammerstone (Fig. 78e).

Pestles

Two pestles were located in Excavation Area 1. One is an elongated cobble that has been somewhat pecked and ground into its present shape, possibly for obtaining a better grip (Fig. 79a). Both ends of this specimen have been used as a pestle, with the larger end showing the greater use. The weight of this pestle is 2297 g (5.06 pounds). The exact provenience of this specimen is unknown as it was unearthed by the grader blade in the south end of the excavation unit. This suggests that it was not in association with the occupation surface.

The second specimen (Fig. 79b) is morphologically very different. It is squat, and only one end was used as a pestle. Most of the pebble has been heavily pecked, once again possibly to make it easier to grip the pebble during use. The weight of this pestle is much greater than the other specimen, being 2590 g (5.71 pounds). The provenience of the squat pestle within Excavation Area I is unknown.

Hammerstones

Haury (1976: 279) identified several different types of hammerstones at Snaketown on the basis of shape and use characteristics. We have already discussed Haury's "angular" hammerstones within the category of core tools. "Spheroid" and "discoid" hammerstones at Snaketown are termed "globular" in this analysis. Seven globular hammerstones were found at Gu Achi. All of these are stream cobbles of dense material that were, no doubt, picked up because of their heaviness and globular shape. Two were found in Excavation Area I. A well-used and battered specimen of basalt (Fig. 80a) was found next to a plainware storage jar (Pot #5), while the other specimen came from slightly above the occupation surface near Hearth 1 (Fig. 80c).

Another type of hammerstone described by Haury is his category of "elongated" stream cobbles made from dense material. One such specimen was found by the grader blade in the southern portion of Excavation Area I. This specimen (Fig. 79c), possibly of diorite, has a deep pit near one end, similar to those at Snaketown. Unlike those at Snaketown, however, the Gu Achi hammerstone has been highly polished, especially around both ends. The purpose of the polish, and the function of the specimen in general, is problematic.

The hammerstone type that Haury refers to as "file-hammers" (1976: 279, 280) is absent from Gu Achi. These are elongated cobbles of schist or other abrasive material that presumably were used for working shell. Because of the tremendous amount of shell-working that must have gone on at Gu Achi, the lack of file-hammers is surprising. Perhaps some of the many small frag-

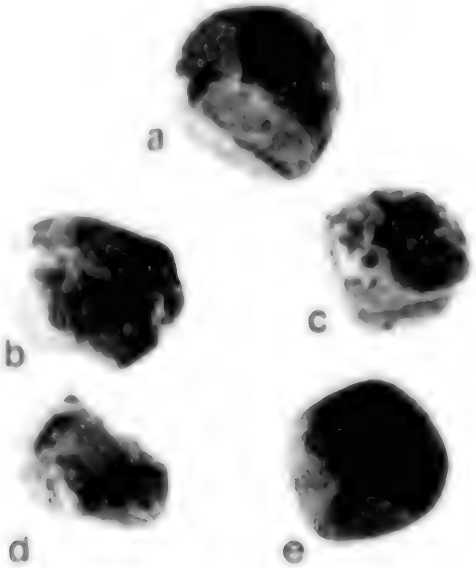

Fig. 80. Hammerstones.

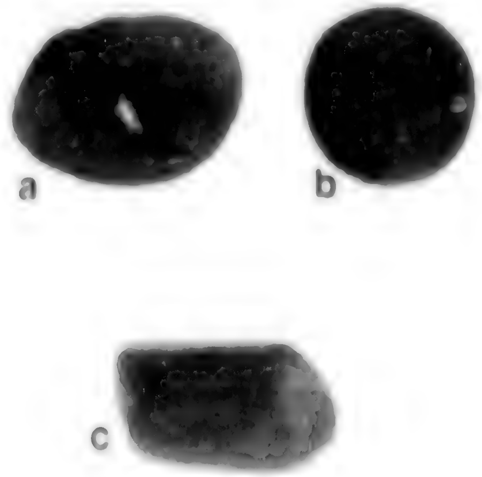

Fig. 81. Polishing stones.

ments of tabular schist at the site, seemingly unmodified, may have served in such a capacity.

Miscellaneous Worked Stone

Miscellaneous worked stone includes the stone from Gu Achi that has not already been described as "Chipped Stone" or "Ground and Pecked Stone." Eleven different categories, including 18 individual specimens, are discussed here. Table 30 lists all specimens.

Polishing Stones

Polishing stones are grinding-faceted, waterworn cobbles that are differentiated from "handstones" on the basis of small size (Fig. 81). Polishing stones are generally considered to have been used for polishing pottery before firing. Two polishing stones, one a complete, well-used discoid (Fig. 81b), were found 10-15 cm above the ramada floor in Excavation Area 1.

A most unusual polishing stone was found on the surface at Locus BB. This round pebble of green quartzite has a distinct grinding facet on one side and a slight polish on the other (Fig. 84a). This specimen is tiny: 2.0 cm is its maximum diameter. This is slightly more than half the size of the smallest polishing stone reported from Snaketown--3.5 cm (Haury 1976: 283). The function of such a miniature polishing stone is unknown, although it may be that miniature stones were used for miniature pots.

Multipurpose Discoidal Stone

Excavation Area 1 yielded a large share of interesting and unusual objects. An object that has been termed here as a "multipurpose discoidal stone" is no exception. This specimen was found in association with the Southern Pit. The "bottom" is flat, and the "top" convex (Fig. 84b). The material type is diorite, a very rare substance at Gu Achi, and this particular specimen appears to have been pecked into its present shape and then was highly polished on all surfaces. It is considered multipurpose because the bottom and two spots on its sides were used either as an anvil and/or as a hammerstone. Also, a series of parallel, lightly incised lines are clustered in an area approximately 9 cm^2 on its top. These lines appear to result from using the stone as a "rest" for some kind of cutting, sawing, or grinding activity (shell jewelry manufacture? leather-cutting?). Other objects of this nature have not been previously reported from Hohokam sites, though "discoidals" of unknown function at Snaketown may be related (Gladwin and others 1937: 114, Plate LXXXIV).

Abraders

Two abraders made from irregularly shaped pieces of pumice were found in association with the occupation surface in Excavation Area 1. One of these had 10 separate use grooves worn into its sides and edges; the other had two lightly worn grooves. The grooves ranged in size from 0.3 to 1.1 cm. The abraders may have been used for working shell (especially bracelets), bone awl production, or perhaps woodworking (arrow shaft manufacture?).

Palettes

One whole and one fragmentary palette, both with raised incised borders, were found at Gu Achi. The fragmentary specimen was located in probable association with the upper occupation surface in Excavation Area 2 (Fig. 84d). It is small, only 5.0 cm in width, and its incised design resembles that of Sacaton phase palettes from Snaketown (Gladwin and others 1937: Plate CV b).

The whole palette was inverted against the side of a plainware storage vessel (Pot 5) on the occupation surface of Excavation Area 1. A battered quartz crystal was found with it (Fig. 82). This palette exhibits a hachured and cross-hachured pendant triangle design with scroll motifs in each of the four corners. Nearly identical specimens have been reported in large numbers from the late Santa Cruz and Sacaton phases at Snaketown (Gladwin and others 1937: Plate XCVII g, Plate CV a, c, d).

Carved Stone

Two fragmentary carved stone specimens were found at Gu Achi. One of these is the margin from a chalcedony object of unknown shape; it has three cut grooves (Fig. 83b). The other specimen, from the upper levels of Excavation Area 4, is a small ring-sized disc of light-weight vesicular basalt that is approximately half complete (Fig. 83a). The outside of the disc has been cut by a series of vertical and horizontal grooves. The central portion of the disc has been biconically hollowed. A small drilled perforation may have been placed at its center, which suggests that this object may have been used as a pendant.

Pitted Stone

A small cobble of vesicular basalt that was found on the site surface contained a conical depression on one side. The conical depression is 3.5 cm in diameter and 1.2 cm in depth. No wear was observed inside the depressed area, and, except for the symmetry and the depth of the depression, the stone appears completely natural. Similar objects have been reported from Snaketown (Gladwin and others 1937: Plate LIV d) and Paloparado in the Santa Cruz Valley (DiPeso 1956). DiPeso has suggested that these served as "stone spindle bases" for use in spinning. Such use for the Gu Achi specimen is an interesting possibility, but the lack of more satisfactory provenience prohibits speculation.

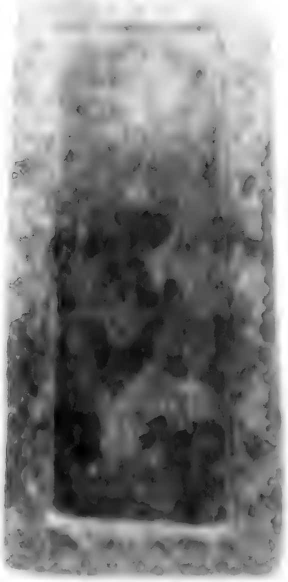

Fig. 82. Palette and quartz crystal found together next to storage jar (pot 3) in Excavation Unit 1.

Fig. 83. [illegible] stones of unknown function.

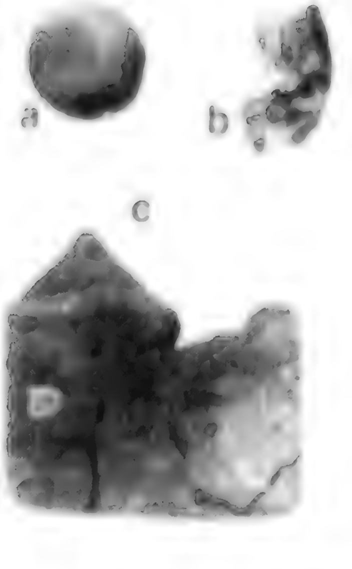

Fig. 84. Miscellaneous worked stones: (a) miniature polishing stone, (b) ground copper ore, (c) turquoise bead, (d) palette fragment.

Fig. 85. Ground-discoidal multipurpose tool of diorite. Note the cut marks in the right-central portion of the stone.

	Provenience	Material	Description
Polishing stone	Excavation Area 1	quartzite	discoidal, bifacial, 3.6 x 5.0 cm (Fig. 81b)
	Excavation Area 1	quartzite	fragment, unifacial, small elongated cobble
	Excavation Area 2	gneiss or schist	1/2 complete, unifacial, elongated cobble
	AC Quad	quartzite	flat oval cobble, unifacial, 8.0 x 5.6 x 2.0 cm (Fig. 81a)
	AC Quad	limestone	oval cobble, bifacial, 7.5 x 4.2 x 3.3 cm (Fig. 81c)
	Locus DD	quartzite	round pebble, bifacial, 1.6 x 2.0 cm (Fig. 84a)
Multipurpose discoidal stone	Excavation Area 1	diorite	discoidal, heavily ground and polished use marks, anvil depressions, 10.3 x 9.7 x 4.2 cm (Fig. 83)
Abrader	Excavation Area 1	pumice	flat and irregular shape, exhibits 10 worked grooves, 9.5 x 8.1 x 2.4 cm
	Excavation Area 1	pumice	flat, possibly one or two worked grooves, 6.6 x 5.0 x 1.7 cm
Palette	Excavation Area 1	phyllite	raised incised border, spiral and pendant triangle design, 17.1 x 8.3 x 1.1 cm (Fig. 82)
	Excavation Area 2	phyllite	fragment, raised incised border, geometric design, 4.7+ x 5.0 x 0.5 cm (Fig. 84d)
Carved stone	Excavation Area 4	vesicular basalt	1/2 complete, circular band with drill hole(?) through the center, geometric carving, 3.1 x 1.5 cm (Fig. 85a)
	Locus V	chalcedony(?)	fragment, unknown object, margin is deeply notched, 2.1 x 1.0 x 0.5 cm (Fig. 85b)
Pitted stone	Miscellaneous	vesicular basalt	round cobble with conical depression, cobble 6.1 x 3.0 cm, depression 3.5 x 1.2 cm
Bead	Locus V	turquoise	0.8 x 0.6 x 0.3 cm, biconically drilled hole 0.2 cm (Fig. 84c)
Mosaic fragment	Excavation Area 4	schist	quadrilateral with rounded corners, edges beveled, 1.3 x 0.2 cm
Quartz crystal	Excavation Area 1 (with palette)		edges heavily battered, side missing, 4.7 x 2.9 x 2.1 cm (Fig. 82)
Ground mineral	AC Quad	copper ore	one small grinding facet 1.4 x 0.6 cm, 2.7 x 1.6 x 1.0 cm (Fig. 84b)
Red ochre	Excavation Area 1		several small lumps from various proveniences

Table 16. Miscellaneous worked stone summary.

Bead

An irregularly shaped turquoise bead was found on the surface of Locus J. This small bead had been ground on nearly all surfaces and has a biconically drilled perforation (Fig. 84c). Turquoise shows up in small quantities at most Hohokam village sites during the Colonial and Sedentary periods, and its presence at Gu Achi is not unusual. This particular specimen can be assigned to the late Santa Cruz/Sacaton phase transition because cultural deposits of this time period surrounded the bead. Plans are being made to have this specimen subjected to microprobe and trace element examination to determine the original source of the turquoise.

Mosaic(?) Fragment

A small flat piece of worked schist was found in Excavation Area 4. This specimen, approximately 1.3 cm in diameter and 0.2 cm in thickness, is squarish with rounded corners. One side has what appears to be broad beveling around all edges. The function of this specimen is unknown, but the uniform appearance and the presence of beveling suggests use in mosaic work. To my knowledge the use of schist has not previously been reported in this capacity. Turquoise, iron pyrites, and cut shell were used for mosaic work.

Quartz Crystal

A heavily battered and damaged quartz crystal (Fig. 82) was found in association with the inverted palette in Excavation Area 1. Two distinct flake scars appear on one side of the crystal, but, rather than being used as a source for flakes, it is possible that the quartz crystal was important in and of itself. The battering and flake removal may relate to the attempt to make sparks or produce powder for certain magico-religious purposes. It is certainly possible that Hohokam shamans viewed quartz crystals in much the same manner as did the Papagos.

> The shaman's most precious possession was his crystal, which shed light "like your car lamps" on the seat of disease or the hiding place of an evil shaman. Generally, a shaman possessed not one, but the ceremonial number, four. According to legend, these flakes of quartz are the solidified saliva of I'itoi [a Papago deity], who spat on the head of the first shaman so that saliva entered the man's heart. All shamans,

> supposedly, are able to keep their crystals in their hearts, and it is these which give their saliva its power if they blow it over a patient (Underhill 1946: 271).

Whatever its purpose, the Gu Achi specimen was found in association with the palette and rested on the same occupation surface as several other unusual artifacts--within a radius of 2-3 meters.

Ground Mineral

A small irregular chunk of copper ore (malachite?) was found on the surface of the AC Quad. This specimen (Fig. 84b) has a small grinding facet on one side, suggesting that it had either been tested for the possibility of making an ornament or had been ground to produce a powder for use as color in pigment.

Red Ochre

Several small chunks of red ochre were obtained from various provenances in Excavation Area 1. In all cases the ochre had been admixed with clay, presumably in preparation for use as paint. Most of these chunks were from the thin layer of ochre that was in contact with the occupation surface in the eastern side of Excavation Area 1 (see Chapter 3).

Worked Bone, Shell, and Perishables

Items of shell and worked bone recovered from Gu Achi are discussed in considerable detail in this volume by Ferg (Appendix E) and Johnson (Appendix D), respectively. Only a few points will be touched upon here.

Bone

Worked bone is nearly always just a small fraction of the artifacts found in Hohokam sites, and Gu Achi is no exception. Most of the worked bone is utilitarian objects such as awls or hairpins or an occasional bone tube. At Gu Achi there is no evidence for the carving or incising of bone. However, as such specimens occur primarily with cremations (Haury 1976: 302), more work at Gu Achi, especially in areas where cremations are found, will most likely recover some carved bone.

Shell

Ferg presents a thorough picture of the types and distribution of shell at Gu Achi. The shell assemblage at Gu Achi compares favorably to that at Snaketown in terms of size and of the types of shell-working activities pursued at the two sites. The large amount of *Glycymeris* debitage found in Locus D further suggests that the favorable comparison between the two sites can be made for the Pioneer period.

Clearly, the Gu Achi Hohokam were somehow procuring large amounts of shell and manufacturing shell products at the site. The substantial amount of finished or partly finished shell products most likely more than satisfied the needs of the Gu Achi occupants. Ferg (Appendix E) suggests that Gu Achi may have served as a major stop along a shell route between the Gila Valley and the Gulf of California. What is unclear here is whether or not this "stop" is that of *people* (presumably from the Gila Valley) traveling between the Gila Valley and the Gulf of California, or simply of *shell* gathered by the occupants of Gu Achi who then traded it to the Gila Valley.

Perishables

Other than the charred remains of plants recovered during flotation analysis and a few lumps of burned adobe with reed or twig impressions from Excavation Area 1, no perishables were found at Gu Achi. There can be no doubt, however, that perishable products were a major portion of Hohokam material culture. Excavation of long-sealed rooms at the historic Hopi pueblo of Walpi has revealed that perishable remains can account for more than 80% of a total artifactual assemblage while non-perishable items such as lithics and ceramics account for less than 20% (Charles E. Adams 1979: personal communication).

It is likely that much of the perishable material reported by Haury from Ventana Cave (Haury and others 1950) is contemporary with the occupation of Gu Achi. Unfortunately, the dating of the rockshelter deposits prevents us from establishing with any certainty exact relationships between assemblages from the two sites. Burials 9 and 11 at Ventana Cave date to the late Santa Cruz or Sacaton phases (Haury and others 1950: 467, Plate 56), which suggests the possibility that these may have been of Cu Achi inhabitants or some other nearby Papaguerian Hohokam village. The association of these two burials with articles of clothing and other possessions gives us an imperfect but fascinating glimpse of rarely recovered aspects of material culture.

Chapter 5

CHRONOLOGY, SUBSISTENCE PRACTICES, AND SETTLEMENT PATTERNS AT GU ACHI

In the previous chapters of this volume the physical setting of Gu Achi has been described, and a detailed description and analysis of its artifactual contents have been provided. The present chapter synthesizes this data base and relates it to pertinent ethnographic literature and the specialized analyses presented in the Appendices in an attempt to understand better the site chronology and the subsistence practices and settlement patterns of prehistoric Gu Achi.

Chronology

Our first concern is with chronology. The building of substantive behavioral and social models for any archeological population is governed to a considerable extent by an ability to date past events. This is a particularly thorny problem for southern Arizona archeologists because they cannot apply the benefits of tree-ring dating techniques to their assemblages. The student of Hohokam archeology must often rely on archaeomagnetism, radiocarbon dating, or, most commonly, ceramic dating. Numerous problems are associated with each of these techniques (Haury 1976; Dean 1978; Kelley in press). At Gu Achi, the dating of features and cultural assemblages relied primarily on a combination of ceramic dating and diagnostic non-ceramic artifacts. In addition, four radiocarbon dates were obtained from Excavation Areas 1 and 2.

Methodological and Technical Problems in the Use of Ceramic Dating

Ceramics were generally the most useful tool for getting at cultural and temporal relationships of the artifactual deposits at Gu Achi. Several problems are immediately apparent, however, including (1) the validity of the Hohokam ceramic sequence, (2) mixing of deposits caused by the great length of occupation at the site, (3) mixing of deposits by sheet flooding, (4) dating of deposits with few or no decorated ceramics, and (5) establishing contemporaneity between deposits of the same cultural phase. These problems are addressed below.

The validity of the Hohokam ceramic sequence. Upon reexamination of the radiocarbon dates at Snaketown, Plog (in press) has recently suggested that the decorated Hohokam ceramic sequence as defined by Haury (1937, 1976) should be greatly revised. Plog bases his suggestion on the premise that several of the Hohokam decorated pottery types either greatly overlap or are absolutely contemporaneous. Similar proposals had been made earlier by Gladwin (1948), DiPeso (1956: 347-348), and Bullard (1962). Ample evidence seems to demonstrate that Hohokam decorated ceramics do indeed seriate temporally, at least beginning with Snaketown Red-on-buff and lasting through Casa Grande Red-on-buff (Masse n.d.b; see also Schroeder 1940). There is, of course, some overlap of characteristics between sequent pottery types, as would be expected as styles and meanings change. Haury (1976: 201) has stated that

> What has been labeled as one type may embody elements that forecast dominances and useful identifiers in the next emergent type; similarly a type may retain traits of a previous one as a reminder of the ancestral form.

Haury (1976: 202) further notes

> The wide scale retention of the patterned behavior of potters that produced one standard form while yet another was coming into being does not fit the generally accepted rule of cultural dynamics where attributes appear, enjoy a period of popularity, fade, and are replaced by some descendant form. In other words, change is the product most often of evolutionary forces at work. These changes affected not only the art but also the artist. The chances are that the irreversibility of evolution in the biological field also held for cultural change, that by and large there was seldom a return to a set of attributes that once characterized a social group.

There does seem to be a one-to-one correspondence between Hohokam decorated pottery types and associated phases. For example, Santa Cruz Red-on-buff is the dominant pottery type of the Santa Cruz phase, with small numbers of Gila Butte Red-on-buff (usually a late style) and small numbers of Sacaton Red-on-buff (usually an early style) also present. However, the dates tentatively assigned to these phases by Haury (1976: Table 16.1) do not necessarily reflect the actual absolute dating of the phases. Thus, the beginning of the Snaketown phase may be as late as A.D. 450-500 in one area and the end around 500 in another area rather than the span of A.D. 350-550 as posited by Haury. The important issue to remember here is that the phases and their associated pottery types do seem to have an independent reality. While the absolute dating of southern Arizona Hohokam sites has not yet been perfected, we can nevertheless relatively date assemblages within a phase (early--late) on the basis of certain evolving attributes. The ceramics attributed to the Vahki, Estrella, and Sweetwater phases may represent an important exception to this phase/type correspondence (Masse n.d.b), but, because ceramics earlier than the Snaketown phase were not found at Gu Achi, this problem will not be addressed.

Recent archaeomagnetic dating at Hohokam sites in the Santa Cruz and San Pedro River Valleys indicates a possible "cultural lag" between these regions and the core area of the Gila River Valley. Ceramic types and styles, architecture, and other aspects of material culture in the Santa Cruz and San Pedro River Valleys lag behind similar manifestations at Snaketown by 100 years or more if the archaeomagnetic chronology is accepted (see Doyel 1977b: 109-111; Greenleaf 1975a: 44, 52, 109; Masse n.d.a). Admittedly, cultural conservatism by some of the regional populations may account for a small part of this difference. However, it is not likely that a society as vigorously involved in trade and exchange as the Hohokam manifestly were would contain many regional isolates. Thus, major changes in pottery styles at Snaketown should be expected at sites such as Gu Achi (less than 100 km (62 miles) from Snaketown) certainly within no more than one or two generations of potters. For the purpose of this study, then, changes in pottery at Gu Achi are assumed to be contemporaneous with analogous changes in the ceramics at Snaketown. And as stated in Chapter 1, the tentative phase dates suggested by Haury (1976: Table 16.1) are used to provide a conceptual framework for dating Gu Achi.

Mixing of deposits caused by the great length of occupation at the site. Gu Achi witnessed several hundred years of human occupation. It might then be expected that, as at Snaketown (Haury 1976: 198-199), considerable mixing of occupation levels occurred. Surprisingly, the survey and excavation of Gu Achi suggest that this was not the case. Most of the 44 loci seem to have been single phase temporal components representing a few generations of activity. For example, surface manifestations at Loci B, C, J, and K represent occupation solely during the transition between the Santa Cruz and Sacaton phases. Excavations near these loci (Excavation Areas 1-6) support the surface observations. Likewise, the surface of most of Locus D indicates an occupation in the transition between the Snaketown and Gila Butte phases. Inspection of materials in the erosional channels of this locus corroborates the surface evidence.

It appears that the inhabitants of Gu Achi practiced a shifting intrasite settlement pattern. Single component loci are Locus D (with the exception of the later enclaves of Loci Q and R) north of PIR 34 and those loci west of the possible canal (Locus FF). As expected, mixing seems to be most prevalent towards the center of the site (Loci M, U, V). Haury (Haury and others 1950: 13-14) has argued that because vertical stratigraphy is lacking in most Papaguerian sites, horizontal stratigraphy must be depended on more than is true for sites in other regions. The data from Gu Achi indicate that not only is horizontal stratigraphy possible, but, as discussed in this chapter, the distribution of these single component loci greatly facilitates our understanding of social and settlement patterns.

Mixing of deposits by sheet flooding. The effect of sheet flooding on many loci is notable in that the surface concentrations of several loci (for example, C, I, K, J, L) are obviously elongated in the direction of water flow (east--west). The manner in which sheet flooding and erosional and depositional processes in general have affected the cultural remains at Gu Achi is a serious concern. Unfortunately, these processes are poorly understood at present.

Sheet flooding has not seriously disrupted our potential to estimate dates for most loci. There has certainly been some movement and mixing of artifacts within individual loci; sherds from one Santa Cruz Red-on-buff vessel in Locus V were found scattered over a 20-meter-square area. However, most loci are single components and are usually spatially separated from one another by several meters. Thus, mixing between loci seems to be minimal.

One interesting possible effect of sheet flooding was seen in Locus II. Most of this 750 sq. m area is only lightly to moderately covered by discontinuous concentrations of trash though one extremely heavy concentration about 3 m in diameter was observed. Interestingly, most of the cultural material was observed in small depressed pockets that were on the average 4-5 m in diameter and from 5 to 10 cm below the surrounding ground surface. It is not known if this pattern was created by wind or sheet wash. More importantly, this pattern suggests that areas not presently covered by surface cultural material may, in fact, contain significant subsurface deposits.

A puzzling phenomenon, possibly related to sheet flooding, was noted in erosional exposures at several loci. There a rich occupation layer 30-45 cm below the present ground surface was overlaid by 20-25 cm of relatively culture-free silts and capped by fairly dense surface concentrations of artifacts at or within a few centimeters of the surface. In particular this was observed in the adjacent Loci DD and OO. Logically, these layers of cultural material simply represent temporally discrete occupations separated by whatever time it takes to build up 20-25 cm of relatively sterile silts between them. However, these two levels of occupation date to the same cultural phase (Santa Cruz). It would thus appear that the layer of sterile silts was deposited rather quickly, perhaps as the result of one or a few floods, during the Santa Cruz phase.

Alternatively, as suggested in our discussion of Locus DD (Chapter 3), the two levels of cultural deposits may be, in fact, contemporaneous. This proposition assumes that some of the surface scatters represent the deflated remains of trash mounds associated with the lower occupation surfaces. The occupation surfaces were covered over with a thick layer of flood-deposited silt, and subsequent recent erosion has exposed and spread the material from the trash mounds. Such a process may explain why most of the pre-Classic period loci seem to lack evidence of specific activity areas, as might be expected if the surface concentrations represented actual occupation levels. Instead, the surface loci exhibit the kinds of material that would normally be found in trash deposits. If future testing at Gu Achi reveals the basal remnants of trash mounds in these loci, this hypothesis will be validated. Also, nearly all surface hearths observed during the survey date to the Sells phase. It is obvious that these features are eroding in situ, and it is also apparent that there had been a significant buildup of flood-deposited silts between the Sacaton and Sells phase occupations. This fact is consistent with the deflated trash mound hypothesis.

These explanations of depositional and erosional events at Gu Achi are preliminary and can only be satisfactorily evaluated by future fieldwork. Understanding the non-cultural processes of site formation at Gu Achi will, of course, greatly aid our dating and interpretation of the cultural remains.

Dating of deposits with few or no decorated ceramics. While most of the loci at Gu Achi contained several identifiable decorated sherds, a few loci had just one or two such sherds or none at all (for example, Loci N, O, P). Experience with the easily dateable loci led to some general expectations of what sorts of material culture items should be found in pre-Classic Hohokam assemblages as opposed to Sells phase assemblages.

Sells phase assemblages usually have large numbers of ground stone specimens, few numbers and varieties of marine shell (when present, usually limited to Glycymeris bracelets and unworked pieces of Laevicardium), frequent use of jasper and chert, larger numbers of choppers, well-made tabular knives, a large percentage of sand-tempered and schist-with-sand-tempered plainware pottery, and, occasionally, redware pottery.

Pre-Classic Hohokam assemblages nearly always include large numbers of unde[illegible] buffwares, lack redwares (with the exception of Vahki Red in Locus D), have a small percentage of schist-with-sand-tempered plainware pottery but large amounts of schist-tempered plainware, large numbers and varieties of shell (including Glycymeris bracelet manufacturing debitage), few pieces of ground stone, large quantities of tabular schist but few well-made tabular knives, and rare use of jasper and chert. Late Snaketown/Gila Butte phase loci can be separated from later Hohokam loci on the basis of distinctive plainware vessel shapes and the fact that schist is more finely ground in schist-tempered vessels. These loci contain fewer varieties of shell, and the Glycymeris bracelets are generally thinner in the earlier assemblages.

These differences are, no doubt, largely the product of the activities carried out in the respective loci. The pre-Classic period Hohokam loci probably represent habitation areas while the Sells phase loci represent some type of specialized activity, most likely related to agriculture. Because of the differences, we can roughly sort out and date nearly all the loci at Gu Achi.

The only features that really cannot be dated by this methodology are the isolated hearths that have few, if any, associated artifacts. Datable Sells phase hearths seem to occur much higher stratigraphically than the earlier pre-Classic Hohokam occupation surface. Thus, I suspect most observed isolated hearths (such as Locus [illegible]) date to the Sells phase. However, the closer these features are to areas of active erosion near Gu Achi and Anegam Washes, the less reliable this suggestion is likely to be.

Establishing contemporaneity between deposits of the same cultural phase. The use of tree-ring dating techniques in northern Arizona has enabled archeologists to refine temporal controls in archeological analysis to units as small as five-year intervals or less. This has permitted the detailed reconstruction of certain demographic and social patterns of behavior for several prehistoric populations (for example, see Dean 1970).

Dating techniques with similar temporal refinement are critically needed for sites such as Gu Achi. Unfortunately such dating techniques are most likely still far in the future. No attempt was made to obtain archaeomagnetic samples from Gu Achi. Such dating would probably not have been feasible because of the poor quality of most areas of burned soil. A few radiocarbon dates were obtained, but these seem to be no more reliable than dating by ceramics. Thus, establishing contemporaneity between deposits of roughly the same cultural phase must rely on ceramic dating.

In other words, we cannot at present establish absolute contemporaneity for the various loci at Gu Achi. For example, 21 loci were dated to the transition between the Santa Cruz and Sacaton phases. These loci could have been occupied at any time between A.D. 850-1000, or, possibly, A.D. 900-1000. Even one hundred years is a long period of time, and at present we do not know if each locus was occupied the full hundred years (thus implying a substantial population at the site) or if these loci are the result of one small group who moved to a "new neighborhood" every 4 to 5 years. The implications of each extreme are vastly different. To build any sort of demographic or social model from the Gu Achi data, we must rely to some degree on ethnographic analogy, on intuition, and on other Hohokam sites (such as Snaketown) where the chronology may be better defined.

Radiocarbon Dating

Four samples of charcoal collected during the work in Excavation Areas 1 and 2 (see Appendix F) were submitted for radiocarbon dating. The specimens were selected for the following reasons. First, the burned ramada with many items in apparent association is a spectacular feature. It was believed accurate dating would improve our understanding of the nature of early Hohokam subsistence in the Papagueria. Two samples were obtained from the charred ramada posts and were sent to different laboratories to insure dating reliability. Ceramic dating indicated that all of the features in Excavation Area 1 were roughly contemporaneous (that is, dating to the transition between the Santa Cruz and Sacaton phases). To test this, a radiocarbon sample from Hearth 1 was processed for comparison with the dating of the ramada. Finally, a sample from Hearth 1 in Excavation Area 2 was taken to test the hypothesis that Excavation Area 2 is roughly contemporaneous with Excavation Area 1. All four dates were expected to fall with the range of A.D. 900-1000. Radiocarbon samples were not obtained from areas of transitional Snaketown/Gila Butte phase deposits nor from deposits of Sells phase age because all such areas were outside the highway right-of-way.

The dates obtained were not entirely consistent with expectations. The dates for the ramada were A.D. 1000 ± 80 (University of Arizona) and A.D. 785 ± 130 (Geochron Laboratories), respectively. When the sigmas are considered, the ranges are A.D. 655-915 and A.D. 920-1080. There is no overlap.

Several factors may explain this discrepancy. First, during the time between the removal of the burned mesquite posts after excavation and the storage of the collections at the Western Archeological Center, the two post samples from the ramada may have been mixed together accidentally. Thus, it is possible that each laboratory processed a different post. Both posts were approximately the same diameter (15 cm), and they may be approximately the same age if both were living trees when cut for use in the ramada. However, it is certainly possible that the Hohokam may have used dead mesquite in their structures. Upright posts of dead wood could have supported horizontal beams, such as were probably utilized in the ramada. Structures that required flexibility in their support timbers, like the early Piman structures described by Pfefferkorn (1949: 192) and Verlarde (Wyllys 1931: 132-133), most likely could not be built from dead wood. Thus, depending on how long the tree were dead, the resultant date would be that much earlier. Further, no attempt was made to control what portion of the post(s) was used in the samples. A sample obtained solely from the dead center (heartwood) of a tree would yield an earlier date than a sample obtained from the outermost portion (see Dean 1978 for a more detailed discussion of this problem).

On the basis of other evidence (especially ceramic dating), the University of Arizona date more closely approximates the expected date of the ramada structure, for stratigraphic evidence indicates that the ramada is the youngest cultural feature in Excavation Area 1. The Geochron Laboratory date, then, may be somewhat too early because of any one or a combination of the factors discussed.

The date obtained from Hearth 1 in Excavation Area 2 is also puzzling. A date of A.D. 760 ± 130 (Geochron Laboratories) was reported, with a sigma range of A.D. 630-890. Once again, this date appears to be somewhat too early for the associated material culture, especially since Hearth 1 was associated with the upper occupation surface. Bell and Castetter (1937: 39) have noted that some groups, such as the Yaqui, used dead mesquite branches for fuel. This practice yields dates earlier than the actual burning of the wood. However, the date for Hearth 1 in Excavation Area 2 is almost identical to the Geochron Laboratory date for the ramada in Excavation Area 1. The sigmas of these two dates overlap between A.D. 615-890. This suggests that the two areas are probably contemporaneous, though probably at a slightly later time period than indicated by the dates themselves.

The final radiocarbon date from Gu Achi is in several respects the most perplexing. This is the date of A.D. 550 ± 125 (Geochron Laboratories) from

Hearth 1 in Excavation Area 1. The sigma ranges between A.D. 425-677. If this dating is correct, two hypotheses may be suggested to explain the presence of this hearth. First, if Gu Achi was not colonized by the Hohokam until A.D. 500 or later, then this hearth may represent a very late Archaic occupation at the site. This hypothesis is weak because other evidence for an Archaic occupation at Gu Achi is lacking and because several burned sherds (including a small eroded, undecorated buffware) were found in association with the fill of the hearth. These ceramics almost assuredly indicate a ceramic period use of the hearth. The lack of Snaketown or Gila Butte phase decorated ceramics in Excavation Area 1 further weakens the likelihood that Hearth 1 dates to this time period. The associated ceramics include 40 sherds to a single schist-tempered plainware bowl(?), three sherds from an altered andesitic(?) grus-tempered plainware jar, and a single small rim sherd from a schist-tempered plainware jar. While I cannot be absolutely certain, because of the small sample, these specimens appear more like Santa Cruz and Sacaton phase ceramics than those of Snaketown and Gila Butte phase age.

The radiocarbon date of this hearth seems too early. The date of its construction and use coincide better with the A.D. 750-1000 range. However, the implication is clear that Hearth 1 is probably earlier than other features in Excavation Area 1, and this raises the question of just how many of the features in Excavation Area 1 are contemporaneous. We will retain the position stated earlier, namely, that most of the features in Excavation Area 1 are contemporaneous with the construction and use of the ramada; however, at least some of the features, especially the hearths, may date to an earlier occupation.

The radiocarbon dates are very important for interpreting past events at Gu Achi, but it cannot be overemphasized that the four dates obtained thus far must be viewed with caution. One has only to look at sites that have been subjected to much more rigorous and comprehensive programs of radiocarbon dating (for example, Haury 1976: 333-338; Kelley in press) to see that many problems still occur with this dating technique.

A Chronological Scenario for Gu Achi

The earliest indications of occupation at Gu Achi are the ceramics found in Locus D. Snaketown Red-on-buff and Gila Butte Red-on-buff predominated in this large area except for two later occupation enclaves, Loci O and R. In the area where erosion was greatest and surface collections were obtained, the most frequent decorated pottery was stylistically transitional between Snaketown Red-on-buff and Gila Butte Red-on-buff. No sherds of Santa Cruz or Sacaton Red-on-buff were observed, and relatively few specimens of "pure" Snaketown or "pure" Gila Butte Red-on-buff were found in this entire area. This suggests two things. First, the initial occupation of Gu Achi appears to have occurred during the transition between the Snaketown and Gila Butte phases or roughly between A.D. 500-600. That few specimens of Vahki Red were found supports this notion. Second, the large amount of trash dating to this time period indicates a sizeable population rather than just one or two families.

The radiocarbon date from Hearth 1 in Excavation Area 1 falls within this early time period. In fact, the sigma of A.D. 425-675 seems to add support to the ceramic date of about A.D. 500-600 for the initial occupation at Gu Achi. However, it is reemphasized that this radiocarbon date is most likely too early for the actual use of the hearth.

The other loci at Gu Achi were dated in a similar manner. The column showing "time period of major usage" in Table 5 reflects this methodology. For example, Locus CC ("Gila Butte/Santa Cruz") had a decorated ceramic assemblage dominated by examples of late Gila Butte Red-on-buff and early Santa Cruz Red-on-buff. Likewise, the decorated ceramics in Loci J and K ("Santa Cruz/Sacaton") were almost exclusively transitional in style between the Santa Cruz and Sacaton phases. A few loci contain single component assemblages of the Gila Butte phase (Loci AA, BB), Santa Cruz phase (Loci NN, OO, PP), or early Sacaton phase (Locus T). This supports the notion of the sequential nature of these phases and their respective ceramic assemblages; however, further testing could well prove these loci to have greater time depth than is presently believed.

The latest pre-Classic period decorated pottery type at Gu Achi is Sacaton Red-on-buff. Several factors suggest that these sherds and the associated occupation of Gu Achi were confined to the early portion of the Sacaton phase. Late design types and vessel forms are lacking; panels of rectilinear motifs, barbed lines, straight necks on jars, and other hallmarks of lateness (see Haury 1976: Fig. 12.24) are absent. Instead most sherds identified as Sacaton Red-on-buff have early features such as tightly everted rims and sharp shoulders on jars, and there is a predominance of flare-rimmed bowls. Excavation indicated that wherever sherds of Sacaton Red-on-buff were encountered, larger numbers of Santa Cruz Red-on-buff and transitional Santa Cruz/Sacaton Red-on-buff sherds were sure to be found (see Table 8: Excavation Areas 1-6).

These facts combine to suggest that Gu Achi was abandoned before late Sacaton phase ceramics could be brought to the site. If we accept Haury's (1976: 354) date of A.D. 1100 as the suggested abandonment of Snaketown (a date which I suspect may be 25-50 years too early), then it is reasonable to assume that Gu Achi was vacated a few generations earlier, probably some time around A.D. 1000-1050. If the burned ramada was one of the latest pre-Classic period features at Gu Achi, as the present evidence indicates, then the radiocarbon date of A.D. 1000 ± 80 (University of Arizona) supports the abandonment of the site by A.D. 1050, and certainly by 1100.

On the basis of the ceramics, there seems to have been a substantial hiatus between the abandonment of Gu Achi by the pre-Classic period Hohokam and its reoccupation by Classic period Sells phase populations. The absence of late Sedentary period ceramics has already been mentioned. Likewise early Classic period ceramic traits are generally lacking. Locus MM did yield a handful of sherds that may be Topawa Red-on-brown (or more correctly "Cortaro" Red-on-brown), which is believed to be the immediate precursor to Tanque Verde Red-on-brown. The date of this pottery type in the Tucson Basin has been estimated around A.D. 1200-1250 (Greenleaf 1975a: 54), though it may have begun by A.D. 1150 if this pottery type is contemporary with its buffware equivalent, Santan Red-on-buff (Hammack 1969), in the Hohokam core area. This still leaves an unaccounted-for gap of 50-100 years between the departure of the Hohokam and the arrival of the Sells phase populations.

Other than Locus MM, the Sells phase loci ceramic assemblages consist of Tanque Verde Red-on-brown, Sells Red, and a variety of plainwares. The sherds of Casa Grande Red-on-buff found at the reservoir (Locus A) are the only intrusive Classic period decorated ceramics noted at Gu Achi. Gila

Polychrome, Jeddito Black-on-yellow, and Fourmile Polychrome, all pottery types that postdate A.D. 1300, were noticeably absent, with the exception of a single sherd of Gila Polychrome in Locus LL. This absence may be due to the limited nature of activities being pursued at the Sells phase loci. The occupation of Ash Hill, a large Sells phase village a few kilometers east of Gu Achi, extends into the late 14th century (Haury and others 1950: 6). At least some of the loci at Gu Achi may be related to the occupation of Ash Hill or other nearby villages. While the evidence is still tenuous, the Sells phase people probably used and occupied the area around Gu Achi from approximately A.D. 1150-1200 to 1450. Most likely, these dates can be extended to other portions of the Papagueria (see Rosenthal and others 1978 for a contrasting view).

Protohistoric and early historic remains were not located at Gu Achi and in the surrounding area. No attempt is made here to discuss this problematic period; a few comments and speculations will be offered in the concluding chapter.

Subsistence

Despite the limited program of excavation at Gu Achi, a significant amount of data on the subsistence practices of its occupants was gathered. Most of this data is from the transitional Santa Cruz/Sacaton phase occupation, but enough data was retrieved in the survey to speculate briefly about Sells phase and Snaketown/Gila Butte phase subsistence practices as well.

Snaketown/Gila Butte Phase Subsistence

Our only knowledge of late Snaketown/Gila Butte phase subsistence practices at Gu Achi comes from the eroded deposits in Locus D. In these deposits were found large numbers of ceramics (both plainware and decorated ware), chipped stone tools and debitage, worked and unworked shell, rectangular manos with all sides shaped, several types of metates including troughs, unidentified burned animal bone, and hundreds of chunks of fire-cracked vesicular basalt.

This assemblage strongly suggests that the early Hohokam at Gu Achi were not just temporary visitors to the site. Rather, they were, at the very least, semi-sedentary occupants. If they had been just transient users of the site, periodically and briefly exploiting some nearby resource or using Gu Achi as a campsite on a shell procurement route, then the nature of the cultural assemblage should be noticeably different. Both the quantity and the diversity of this assemblage indicate lengthy stays at the site. Unfortunately, the best diagnostic of sedentism, house structures, was not observed in the eroded portions of Locus D. However, trough metates and shaped rectangular manos provide evidence that agriculture was probably pursued at the site. Further, the early plainware ceramics at Gu Achi are of sizes and shapes comparable to those at Snaketown, suggesting their use for similar functions at each site, and the early chipped stone tools, including large numbers of tabular schist specimens, appear similar in quantity and type to those of Santa Cruz/Sacaton phase times, when agriculture was intensively pursued. Thus, the present evidence indicates that agriculture was practiced by the late Snaketown/Gila Butte phase population. In turn, this argues for some degree of permanency for the Gu Achi colonists. Dr. Emil W. Haury, who personally observed the cultural deposits in Locus D, also believes that these are remains from a sedentary agricultural population (1978: personal communication).

It is by no means clear how much the early Gu Achi Hohokam relied on agriculture, nor is it possible to be absolutely certain whether these people were seasonal farmers like the historic Papago or year-round occupants of the site (Castetter and Bell 1942). The general lack of late Pioneer period sites in upper bajada and foothill settings in the Papagueria does suggest that sites such as Gu Achi were probably occupied year-round. Settlement pattern data from other regions in southern Arizona indicate that agriculture most likely was at least a co-dominant subsistence pursuit along with gathering during the late Pioneer period (Masse in press a). It is doubtful, however, that the late Pioneer period Hohokam ever depended on agricultural products to the extreme of the later Santa Cruz/Sacaton phase populations.

Santa Cruz/Sacaton Phase Subsistence

The fieldwork at Gu Achi, especially that performed in Excavation Area

1, has given us a wealth of information on the manner in which the late Colonial and early Sedentary period inhabitants of the site were able to sustain themselves in this desert environment. Briefly summarized, the many subsistence-related activities that are inferred in Excavation Area 1 include (1) storage of wild plants and cultigens in pits and in ceramic containers, (2) the preparation of plant (and animal?) foods through the use of fire (Hearths 1-6), including the possible boiling of saguaro syrup, (3) the spinning of cotton and other fibrous material as suggested by the perforated disc and pitted stone, and (4) the grinding of foodstuffs, most likely corn. Enough diverse information has been gathered that we are able to focus on the three major facets of Hohokam subsistence--hunting, gathering, and agriculture--and to discuss each at length. The role of trade as an alternative means of satisfying subsistence needs is also briefly discussed.

Hunting. Very little information on hunting practices at Gu Achi was obtained. Out of a total of 776 faunal elements collected, only an estimated 22 animals (and perhaps as few as 16) could be identified (see Appendix D). Even if we assume that all of these date to the transition between the Santa Cruz and Sacaton phases (A.D. 850-1000), which they may not, this total averages to only one animal brought to the site every 6.8 years. Historically, we know that a Papago village with only 10 families would bring 12-15 deer back to the village per year (Castetter and Bell 1942: 58), not to mention countless rabbits, birds, rats, and other animals. Obviously it is difficult to make interpretations on the basis of the limited information provided by the assemblage at Gu Achi.

The scarcity of faunal remains in Hohokam sites raises an interesting problem. Johnson (Appendix D) has noted that the majority of the bones at Gu Achi were badly weathered, and it is likely that the natural processes of weathering for bone in semi-arid regions may have caused the complete destruction of many faunal remains and the reduction of other specimens to unidentifiable fragments. Johnson also mentions the "Schlepp Effect" whereby only certain portions of large game animals are brought back to the village by the hunter. He tentatively suggests that bighorn sheep skulls are disproportionately overrepresented at Gu Achi in relation to post-cranial elements. In this regard, other prehistoric Papaguerian sites, such as Valshni Village (Withers 1973: 2), contain large numbers of bighorn sheep skulls and little evidence of post-cranial elements. Historically, (in 1697) Manje noted an immense pile of bighorn sheep skulls at the southern Arizona Piman village of Tusonimoo (Burrus 1971: 573). Thus, for bighorn sheep, both the prehistoric and early historic record indicates that the "Schlepp Effect" was real in at least some sites (see also Castetter and Bell 1942: 67-68).

Johnson (Appendix D) also suggests that any dogs at Gu Achi would have scavenged the remains of small animals, such as rabbits, to a considerable extent. In support of this belief, the analysis of the stomach contents of a modern-day bobcat (a carnivore with an appetite much like that of a dog) has revealed an amazing array of small animals, including the remains of a cottontail rabbit, several birds, a snake, a lizard, and two rats (Johnson in press). Perhaps an even more telling line of evidence comes from the 18th century observations on Sonoran Indians made by Father Joseph Och, a German Jesuit missionary.

> A nonsensical custom among them [Sonoran Indians] is the keeping of innumerable dogs, and to have them in houses. Their love for their dogs is stronger than is their love for their children. My greatest annoyance was the nightly howling and barking of so many hungry dogs. Not a single one, not even the most dangerous, will they dispose of. All puppies are carefully raised, the women even nourish them with their own milk by depriving their own infants. Every man in the family has one dog or more for which he provides not a bite to eat.
>
> The dogs seek their food in the fields, eating grass, maize, even Spanish pepper. At night they dragged off from me whatever they could; leathers, shirts, candles along with the candlesticks. These things had to be searched for either in the churchyard or in the field. The Indians are not angry even when dogs eat up their victuals; indeed, they eat with them from the same dish. Because they cannot give their children any other possessions as property, they give them puppies. These the children drag around all day in their arms, kissing and hugging them, and feed them as well as they can. They call the puppy vacu, and are proud of the fact that they have something of their own (Treutlein 1965: 132).

With scavengers such as these it is almost surprising that any faunal elements survive for the archeologist's trowel.

Even with the depredations of dog scavenging, as Johnson points out in Appendix D, rabbits still constituted the largest minimum number of indivduals (MNI) at Gu Achi. In another publication Johnson (in press) has noted that rabbits form a large percentage of the MNI at Hohokam sites in general. He suggests that this may result from the fact that agricultural fields provide an excellent habitat for rabbits, and man, rabbits, and fields act as a mutualistic system. Thus, the fact that at sites like Gu Achi rabbits form a high percentage of the MNI could support the notion that the Gu Achi inhabitants were dependent to some degree on agriculture.

Despite the many problems of bone preservation, had hunting been a major subsistence necessity or pursuit for the Gu Achi inhabitants, more evidence should be found in the Gu Achi artifactual assemblage. Here reference is made to the heavy emphasis on scraping tools in the chipped stone collection. Also, the number of projectile points found is not proportionally greater than at Snaketown and other such riverine sites. Of course, it is entirely possible that the Hohokam use of stone projectile points was limited to special activities, while most hunting was done with arrows having foreshafts of hard wood, the points of which were simply sharpened. Such a pattern was noted by Pfefferkorn for middle 18th century Piman Indians (1949: 203), and Haury found arrows both with stone tips and with sharpened foreshafts in prehistoric contexts at Ventana Cave (Haury and others 1950: 418-419). Thus, quantification and distribution of chipped stone projectile points at the site may not be a reliable measure of the intensity of hunting activities.

The artifact assemblage at Gu Achi also lacks large numbers of worked bone specimens. In this respect, Gu Achi is like most other Hohokam sites, including Snaketown (Haury 1976: 203). I suspect that had the Gu Achi Hohokam relied heavily on hunting, use of bone for utilitarian and ornamental purposes would be more common. However, this suggestion must also be viewed with caution because wood may have been more available and is much more easily worked; this may be the biggest reason for the lack of bone in Hohokam sites (Haury 1976: 302).

The presence of mud turtle (Kinosternon sp.) at Gu Achi indicates that the reservoir (Locus A) contained a permanent water supply. One wonders whether this small body of water might also have attracted occasional migrating waterfowl and provided another source (albeit limited) of food for the Hohokam. The discovery of waterfowl remains in future work at the site might corroborate this suggestion.

Gathering. Much information concerning the gathering of wild plants by the late Santa Cruz/Sacaton phase Gu Achi occupants was brought to light by the flotation (Appendix A) and pollen (Appendix C) analyses of Excavation Area 1. These analyses demonstrate that along with a sizeable collection of corn kernels and a few traces of cotton, there is evidence for the use of mesquite and paloverde beans, cholla buds, tansy mustard seeds, and reeds. Also, I agree with Gasser (Appendix A) that the grain of Agave pollen possibly indicates use of this plant as well. McLaughlin (Appendix C) reports a possible grain of Opuntia (prickly pear), suggesting that prickly pear as well as cholla may have been brought to Excavation Area 1. The nearest prickly pear noted during survey was on the eastern slopes of the Black Hills. However, prickly pear could have been growing nearer to or at Gu Achi during prehistoric times.

Gasser (Appendix A) suggests that the Hohokam were dependent on the resources of three major ecosystems in the Papagueria. These are the floodplain, with its arable land and heavy stands of mesquite; the creosote plain (above the floodplain), which provides additional land for certain types of agriculture; and the foothills and mountain flanks, with their supply of saguaro, cholla, Agave, and other such plants. Gasser defines an ellipitically shaped "catchment" area that includes all three ecosystems and concludes that the exploitation of all three is probably necessary for sedentary populations to survive in the Papagueria.

These ecosystems were no doubt important for the Gu Achi inhabitants, but I am hesitant to accept the notion that all three were absolutely necessary. Gasser originally developed his model of a separate floodplain and creosote plain on the basis of studies in the Santa Rosa Valley, some 15 miles north of Gu Achi. However, at Gu Achi the creosote plain and the floodplain are one and the same. I suspect that more than enough arable land was present in the area between Gu Achi Wash and Anegam Wash, and there would have been no need for additional fields elsewhere.

While the Gu Achi flotation and pollen data suggest an emphasis on the use of foothills resources, there are some questions that can be raised as to where and how these resources were procured. Of four plants from the Gu Achi excavations that are commonly considered mountain or foothills species, only two were positively present at the site. The latter, saguaro and Christmas cholla, are present within the confines of the site today, albeit in small numbers. Thus it is conceivable, though not likely, that these two plants were procured prehistorically at or near the site, and not in the mountains at all. However, the other two plants, Agave and prickly pear (of which single pollen grains were identified), most likely would only have been available in mountainous areas or the rocky upper bajada.

Little use of the mountainous zone by pre-Classic Hohokam was noted in the surveys conducted by Goodyear (1975) and Raab (1974, 1976) in the Slate Mountains and by Stewart and Teague (1974) in the Vekol Mountains, both north of Gu Achi (see Chapter 6). However, they found abundant evidence for the use of these areas by the Sells phase populations. This apparent dichotomy in the use of mountainous resources by the two temporal/cultural populations is critical to our understanding of the importance of these resources for pre-Classic period Hohokam populations. Three alternatives may explain the dichotomy. First, it is possible that the Hohokam consistently used more perishable equipment for the gathering of mountain resources. For example, the Hohokam could have used baskets instead of ceramic vessels and wooden implements rather than stone. Many dateable sites in these three survey areas contained only chipped stone and no ceramics. Perhaps these were Hohokam gathering localities. A second alterative is that the Hohokam made little or no use of the mountain resources. Intuitively such a situation seems unlikely. The third alternative is that only in some areas were the mountain resources gathered by the Hohokam, and those surveyed portions of the Vekol and Slate Mountains did not coincide with the areas used prehistorically. This last alternative also seems unlikely, but it raises the interesting possibility of trade for such resources. Perhaps certain floodplain villages heavily exploited the nearby mountain resources and then traded these items to other villages in the region. An intensive survey of the pediments and flanks of the Black Hills and Sheridan Mountains will be invaluable in determining Hohokam reliance on mountains resources and, in general, the validity of Gasser's three major ecosystem model.

Agriculture. The recovery of corn pollen and several hundred kernels of charred corn, scattered in various locations throughout Excavation Area 1 and the additional finding of a cotton seed and a pollen grain in Excavation Areas 1 and 14 argue convincingly for prehistoric farming at Gu Achi. Both Gasser (Appendix A) and Miksicek (Appendix B) have analyzed these data and have provided stimulating interpretations and models based on them.

As a base for discussing the studies by Gasser and Miksicek, it is necessary to talk about the physical potential for agriculture in the Gu Achi area and to describe what archeological evidence (other than botanical) may indicate the nature of these agricultural practices. Because of the confusion in terms that presently exists in the archeological literature some basic definitions regarding agricultural practices are provided.

All aboriginal Southwestern agricultural practices can be placed within three distinct but not mutually exclusive types. These are (1) Irrigation farming, (2) Dry farming, and (3) Floodwater farming.

(1) Irrigation farming. Irrigation farming uses canals or ditches to bring water from a permanent living source to specific field areas. The critical concern here is that the source has to be permanent, either a river or a spring. The best known examples of prehistoric irrigation from permanent Southwestern rivers are the Hohokam canals of the Gila and Salt River Valleys (Herskovitz 1974; Haury 1976; Masse 1976). The prehistoric population at Montezuma's Well in the Verde Valley, who utilized the perennial waters of the Well for their irrigation needs, exemplify spring-fed irrigation (Schroeder 1948; Schroeder and Hastings 1958: 5, 30). The large, complex water-control system in Chaco Canyon is not considered an "irrigation farming" system as the term is used here, even though elaborate masonry-lined canals are present. The Chacoan system depended on rainfall, a factor that creates different problems and different kinds of scheduling activities than irrigation systems from permanent water sources (see Vivian 1970: 75).

There is no known evidence of prehistoric or early historic irrigation farming in the Papagueria, except for small spring-fed irrigation systems at Quitobaquito in Organ Pipe Cactus National Monument (Castetter and Bell 1942: 48). The irrigation described by Kino and Manje at San Xavier on the Santa Cruz River (Bolton 1919: 205, 236) and those systems along the Sonoita River in northern Sonora lie outside the area of our principal concern, and the prehistoric Sells phase irrigation systems described by Withers (1973: 84-86) near Valshni Village, by Clotts (1915: 82) near Santa Rosa, and by Castetter and Bell (1942: 36) from the Baboquivari Mountains to near Vamori Village 17 miles away are all examples of "floodwater farming."

(2) Dry farming. Dry farming refers to agriculture that is dependent solely on direct precipitation. Thus, dry farming can only be pursued in those regions where sufficient amounts of precipitation come at the proper times of the year. Such farming was practiced by the pre-Classic period Hohokam in the Tucson Basin (Masse in press b), the lower San Pedro Valley (Masse in press c), the Gila River Valley (Haury 1976: 151), and in fact, nearly every place that contained Hohokam settlements. The Hohokam in these regions used water conserving measures such as check dams, contour terraces, and occasional bordered gardens, but these served principally to trap and utilize in situ the direct precipitation and surface runoff. This is related to but separate from floodwater irrigation or runoff farming.

Two notable exceptions are the Gila Bend region and the Papagueria. Recent survey by the Arizona State Museum has failed to obtain any positive evidence that dry farming was pursued in the Gila Bend region by the Hohokam (Lynn S. Teague 1979: personal communication). Numerous surveys in the Papagueria (see Chapter 6) have obtained similar results. This is not surprising because of the aridity of the Gila Bend area, but as Table 1 indicates, the north-central and eastern portions of the Papagueria (Santa Rosa and Sells, specifically) have modern precipitation levels comparable to or greater than the surrounding regions where prehistoric dry farming was practiced. Thus, the general absence of dry farming features (rock piles, check dams, and contour terraces) from the better-watered portions of the Papagueria is of considerable interest.

Possibly the small cluster of rock piles between Gu Achi and the Black Hills may represent an attempt at dry farming. A few scattered piles of unmodified cobbles have been noted in other nearby areas, such as around Kaka and Stoa Pitk northwest of the Castle Mountains (McGuire and Mayro 1978) and in an area about 12 miles south of Santa Rosa. This last area was recorded in 1929 by Frank Midvale, who described the site as "Stone heaps and rare sherds; more than a dozen stone heaps averaging 5' in diameter and 8" in height. Stone heaps look a little more like land clearing than camp centers" (Gila Pueblo I:16:1, Arizona State Museum site survey files).

Some students have suggested that rock piles represent the attempt to augment surface runoff for fields located downslope from such features rather than in situ agriculture (for example, Canouts 1975: 83-84). This suggestion is based on seemingly analogous rock piles in the Negev Desert of Israel (Evenari, Shanan, and Tadmar 1971: 126-147). However, I do not believe that such an agricultural technique was ever employed by the Hohokam (see Masse in press b, in press c for more detailed examination of this problem).

Other alternatives besides dry farming may explain the presence of these rock piles. For example, the ever-observant 18th century Jesuit priest, Father Ignaz Pfefferkorn, noted that

> Near roads are seen small heaps of piled-up stones. These heaps had their origin in an ancient Sonora custom. Each traveler placed a stone at a certain place near the road, and the unconverted still have the habit. From time to time many people made such contributions, and these piles finally resulted. . . . If the Indians themselves are asked why they heap up these stones, they answer, "We do it so that we shall not tire, but rather shall be able to run actively and swiftly over hill and dale, and so that no misfortune will overtake us on the journey." . . . Already some of these stone heaps are almost destroyed, others are disintegrating, and only a few are still evidently maintained (1949: 228).

The etiology of the rock piles at Gu Achi and other locations in north-central Papagueria is not presently known, though some may be related to an attempt at dry farming. Even if this were somehow proven to be true, it is still obvious from the present data that dry farming in the Papagueria never reaches the level of importance seen in most other Hohokam regional areas.

(3) Floodwater farming. There are two types of floodwater farming, one of which was practiced by the historic Papago and most likely by the Papaguerian Hohokam as well. One type, "floodplain inundation" agriculture, was not practiced by the Papagueria Hohokam because such agriculture requires the presence of a permanent living stream. Floodplain inundation agriculture consists of planting crops in the rich moist silts deposited in the floodplains of streams after the final major flooding in the late spring and early summer months. The historic Yuman Indians are notable practitioners of this type of agriculture (Castetter and Bell 1951).

The second type of floodwater farming is termed "runoff" agriculture or "akchin" agriculture. This type of agriculture uses the runoff created by summer storms, diverting it to selected field locations. Such diversion can either take the form of tapping intermittently flooded washes by using brush diversion dams and ditches in a manner similar to irrigating from a permanent stream, or, by use of long brush dikes, low embankments, and small ditches, the shallow sheetwash that flows over broad flat bajadas or valley bottoms can be collected and channeled (Castetter and Bell 1942: 168-169).

The study of historic runoff farming can give us valuable insights regarding its potential for the Gu Achi inhabitants. Runoff agriculture is still productively pursued today on the Papago Reservation, and there is little doubt that the same or similar techniques were used by the Papaguerian Hohokam. Figures 86-89 taken in 1977 during the course of an Arizona State Museum study near Pig Fields (Ko Oidak), west of Sells, illustrate some aspects of runoff agriculture.

Figure 86 shows a successful floodwater agricultural field with small patches of squash in the foreground and rows of corn in the background. Figure 87 shows the traces of a shallow ditch that was excavated from a nearby wash to new fallow fields. Clearly visible in one photograph (Fig. 88) is a post-reinforced brush diversion dam. This structure was designed to prevent floodwater from entering the wash channel on the right, thus encouraging flow in the left-side channel to nearby field areas.

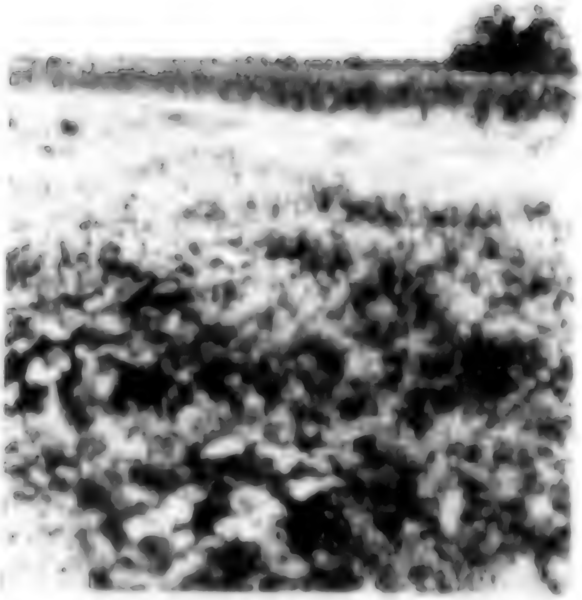

Fig. 86. Successful runoff agricultural field of corn and squash near Big Fields. (Arizona State Museum, neg. no. 45416. 10-3-77)

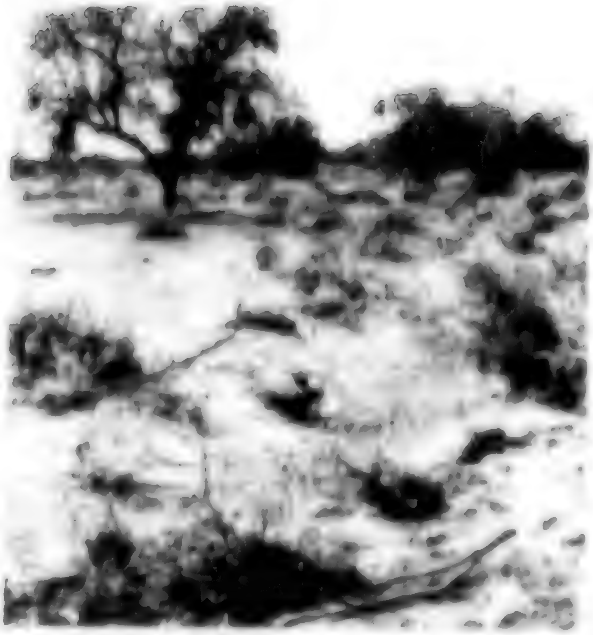

Fig. 87. Runoff irrigation ditch near Big Fields, covered by brush deposits from recent flooding (Arizona State Museum, neg. no. 45418, 10-3-77)

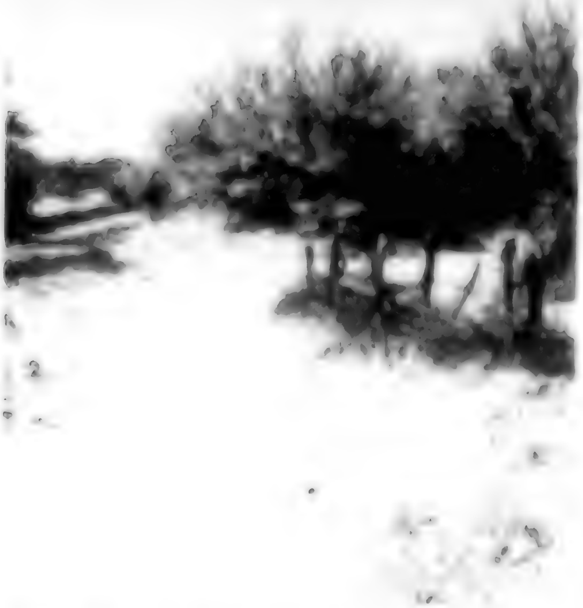

Fig. 88. Diversion structures in large runoff irrigation ditch near Fresnal Village (Arizona State Museum, neg. no. 45428. 11-17-77)

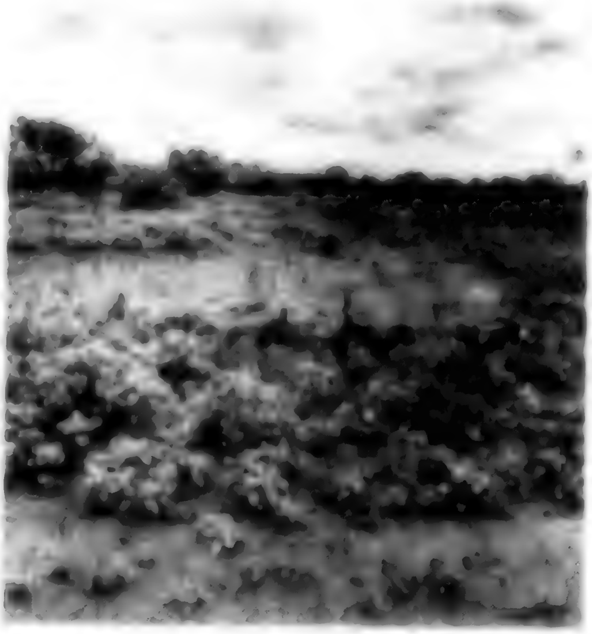

Fig. 89. Check dams of mesquite poles and brush near Big Fields. These structures slow the flow of water and spread it out over the fields (Arizona State Museum, neg. no. 45518, 8-15-77)

Figure 89 depicts a post-reinforced brush fence that served to spread out and conserve sheetwash for in situ agriculture. These photographs also illustrate the large numbers of weeds present in agricultural plots. These weeds serve to shade young crops, provide an excellent habitat for certain animals such as rabbits, and are a source of food ("greens") for human consumption (Rea 1979).

Aboriginal yields from runoff agriculture may have been nearly equal to aboriginal yields from irrigation farming. A recent study by Doelle (1978: 253) near Sells Wash in the Papago Reservation, has demonstrated that runoff agriculture can produce yields of 10-12 bushels of corn per acre, a figure similar to that reported (presumably) for irrigation farming by the Gila River Pima (Castetter and Bell 1942: 54).

The studies by Gasser (Appendix A) and Miksicek (Appendix B) provide an interesting picture of prehistoric agriculture in the Papagueria. Both view agriculture as the necessary ingredient for the pronounced sedentism of the late pre-Classic period populations, and both are justifiably cautious as to the importance of agriculture for the Gu Achi inhabitants.

The gathering aspect of Gasser's "three major ecosystem" model has already been discussed. The other two components of this model (the "creosote plain" and the "floodplain") relate directly to agriculture and the gathering of mesquite that were carried on in the floodplain, while the creosote plain mainly supported seasonal farming camps (that is, "field houses"). Gasser's model is based on the physiography of the Santa Rosa Valley some 15 miles north of Gu Achi rather than on the environment around Gu Achi. In the portion of the Santa Rosa Valley under consideration the floodplain is distinct from the creosote plain; at Gu Achi, however, the floodplain and creosote plain physiographically coincide. I am in general agreement with Gasser's interpretation that the creosote plain in the Santa Rosa Valley was utilized for supplemental agricultural fields. This may have been due to increasing population demands during the Santa Cruz/Sacaton phase transition rather than simply as a way of ensuring a more certain harvest each year. It would be interesting to see if the Santa Rosa Wash creosote plain field camps cluster more in the latter portion of this time period than in the earlier; however, there is presently no mechanism for such precise dating.

While Gasser does not explicitly state as much, his three major ecosystem model seems to be similar to the subsistence model suggested by Bohrer (1970) for the Hohokam at Snaketown. The major difference between these models seems to be that Gasser emphasizes a combination of agriculture and mesquite gathering as the basis for Hohokam subsistence at Gu Achi, while Bohrer indicates that mesquite is an emergency source of food rather than a staple (see also Gasser 1976). It is obvious that runoff agriculture is more unpredictable than irrigation agriculture, but Gasser's model seems to suggest that given the right climatological variables, the general manner of subsistence at Gu Achi was normally not much different than that at Snaketown. If this interpretation of Gasser's model is correct, then I heartily support the conclusions drawn above. (A similar conclusion has been recently stated by Doelle (in press).)

Gasser suggests that cotton may have been grown prehistorically at Gu Achi but then cautiously adds that it could have been traded to the site from the Gila Valley. I believe that the cotton remains at Gu Achi and Ventana Cave strongly indicate that cotton was being grown locally, for Castetter and Bell (1942: 105) were told by informants that the floodwater (runoff) cultivation of cotton had been pursued aboriginally by the Papago.

The detailed study of the Gu Achi and Ventana Cave corn by Miksicek (Appendix B) is of considerable interest. Miksicek indicates that most of the corn kernels at Gu Achi are of a flint variety. Flint corns are generally considered more drought-resistant than flour corns. Also, it is Miksicek's belief that the large number of eight-row kernels may represent a decrease in row number due to water stress. He further suggests that the distortion seen in the Gu Achi kernels and the substantial number of unpollinated rows on the Ventana Cave corn suggest drought.

Miksicek has created a model to explain, in part, the growth and the eventual decline of the late Santa Cruz/Sacaton phase population at Gu Achi. In brief, he suggests that an improved cultigen (a teosinte-introgressed corn), coupled with a more efficient runoff agriculture system, provided the impetus for increasing population size. The population continued to increase in size and relied more and more heavily on agriculture until reaching a point of diminishing returns whereupon several successive years of crop failure decimated the Gu Achi population.

I agree with the major points of this model but have some reservations. First, Miksicek accepts Castetter and Bell's (1942) model of Papago subsistence, which argues that agriculture aboriginally supplied only about 20% of the subsistence needs. While Miksicek does not quantify this aspect of his model, he implies that agriculture before and after the Santa Cruz/Sacaton phase transition approximated the percentage of the historic Papago model. In addition, Miksicek does not believe that Gu Achi agriculture ever satisfied the proportion of subsistence needs (50-60%) as that of the historic Pima (Miksicek 1978: personal communication). I believe that Miksicek is too conservative in his estimation of the importance of agriculture for both the pre-Classic period Hohokam and the Sells phase populations at Gu Achi.

Further, the causes of population decline at Gu Achi around A.D. 1050-1100 have not been identifed yet. A major drought does not show up in the dendroclimatological records of the Colorado Plateau during this time period (Euler and others in press). Probably some climatological cause will eventually be found, as this seems the most logical reason for the simultaneous abandonment of the San Pedro Valley and the Papagueria (Masse in press a).

Trade. Until recently, trade has been considered in vague and uncertain terms for the Hohokam culture. The trading of pottery, shell, and turquoise has long been recognized, but no major attempt was made to understand the mechanisms responsible for such trade.

Several people have focused attention on the possibility that trade in the Papagueria, especially of shell for possible subsistence products, may have been of great importance to the stability and success of the pre-Classic Hohokam and the Sells phase populations (Rosenthal and others 1978; McGuire and Mayro 1978; Doelle in press; Lynn S. Teague 1979: personal communication). The great quantities of shell manufacturing debris at Gu Achi certainly suggest that the site occupants participated in the trade or exchange of this material. However, the role of Papaguerian shell trade has not yet been satisfactorily delineated, and we are presently unable to judge whether the Gu Achi Hohokam were vigorous entrepreneurs or passive distributors of shell to the core area Hohokam. Likewise, we cannot yet determine if the trade centered around subsistence-related materials, such as woven cotton or food, or was chiefly for non-utilitarian objects, such as turquoise and decorated ceramics. The role of shell trade for the Papaguerian Hohokam constitutes an important topic for future research.

Sells Phase Subsistence

The specialized nature of the Sells phase loci at Gu Achi leaves little doubt as to their function. The consistent combination of hearths, [illegible] tabular schist, and metates, coupled with the small size of the loci, and, finally, the general lack of variability in the artifact assemblage suggest that these loci were the focus of processing activities. These loci are a substantial distance from the mountain flanks to the north and some distance from the riparian washes. Their situation seems to rule out the exploitation of plants such as cholla, saguaro, and Agave; and, unless creosote was the resource being exploited, these loci were most likely camps for processing agricultural products. As during the Santa Cruz/Sacaton phase, corn, beans (both "common" and "tepary"), and cotton most likely were the crops grown throughout the entire Gu Achi site under runoff agriculture practices.

While it is not known for certain what plants were being processed in these Classic period camps, the Piman methods for roasting, drying, shelling, and storing corn suggest a possible analogy (Castetter and Bell 1942: 181-183).

> Although the Pimans husked some of their maize, particularly in selecting ears for seed, it was the common practice to partially roast their corn in unhusked ears by placing it in piles and covering with brush; this was set afire, green mesquite branches being used to stir and turn the ears, and, after several minutes of roasting, to throw them out on a bed of grass. During the roasting process much of the husk was burned away. . . . In some cases the process differed to the extent that the fire was made in an open pit and, when it had burned down, the ears were thrown on the embers to roast. It was considered that such partial roasting improved the keeping qualities and facilitated the grinding of corn. Pima and Papago corn was regularly shelled before storing. After

> thoroughly drying, the unhusked, partially roasted corn might be shelled in any of three ways. . . . The second was to remove one or two rows of kernels the length of the ear with the aid of a stone scraper or a sharpened piece of creosote bush wood, then finish by twisting the ear with the hands. . . . Corn was always shelled before being stored, then was ground into meal as needed.

Thus, the Sells phase hearths at Gu Achi may have been used for the roasting of corn, the tabular pieces of schist for the shelling, and the metates for grinding the corn into flour. This explanation does not preclude the use of these features and artifacts for the processing of other types of plants.

The present visibility of the Sells phase loci is due to the fact that they are a substantial distance from the parent village(s) (more than 2 miles?) and were probably occupied for several weeks at a time. This situation should allow for a fair amount of ceramic and lithic trash accumulation. If the parent village had been situated near or at Gu Achi, the need for processing camps would have been obviated. The plants could then be processed in the village itself, as was apparently the case for the pre-Classic period Hohokam. The agricultural system used by the Sells phase populations around Gu Achi is in every sense a "field house" system, much like that used by prehistoric and historic Puebloan societies.

At present we know very little about other aspects of Sells phase subsistence. We can assume that gathering of wild plants was vigorously pursued, as seems to be the case in surveyed mountainous areas a few miles north of Gu Achi (Stewart and Teague 1974; Goodyear 1975; Raab 1976). The brief survey between Gu Achi and the Black Hills failed to obtain any evidence of such pursists. However, more thorough survey is needed to demonstrate such a lack.

Settlement Patterns

Because of our inability to date most of the various loci at Gu Achi to within a smaller time period than one or two hundred years, our understanding of intrasite and regional settlement patterns is severely limited.

However, a few observations of a general nature can be made concerning each of the three major periods of occupation.

Snaketown/Gila Butte Phase Transition

The most notable aspect of the earliest occupation at Gu Achi is the fact that it is localized along a lengthy, narrow strip of land near and paralleling Gu Achi Wash. Late Snaketown/Gila Butte phase transition material was noted only in Loci D and M; thus, remains of this time were more restricted areally than those of any other. However, this material does cover some 35,000 sq. m of site surface, which is a substantial area. Accessibility to water, land for agricultural purposes, and nearness to mesquite groves were most likely the principle reasons for the settlement distribution. In areas of active erosion, numerous hearths and hundreds of randomly strewn burned vesicular basalt cobbles were present. Unfortunately, we have no way of knowing whether this represents seasonal, semi-sedentary use of the site at this time period or permanent year-round occupation. The large numbers of locally made plainware ceramics may suggest year-round occupancy, especially if the manufacture was done in the winter (though Fontana and others (1962: 20) note that most Papago pottery was made in the summer).

Santa Cruz/Sacaton Phase Transition

By the middle of the Gila Butte phase, the total area occupied at Gu Achi is roughly the same as during the Snaketown/Gila Butte transition, but there is a noticeable shift in settlement location from Locus D to areas west and northwest. An interesting pattern is formed by plotting the distribution of loci with Gila Butte phase components; an area is formed that extends south from Locus V through Loci U, Z, AA, BB and then west to Locus CC (see Fig. 20). Locus EE is the only area separated from this arc. Once again we do not know if these loci were occupied contemporaneously or sequentially. Our understanding of population size would, of course, be greatly augmented by such knowledge. Small shifts in settlement location have been ethnographically recorded for Papago villages such as Big Fields, which has been moved several hundred meters north in the past century (William Doelle 1977: personal communication). This movement is related to slight shifts in the channel of Sells Wash, which affected the drawing of water from the wash for use in field areas. However, the applicability of this model to prehistoric shifts at Gu Achi is not known.

During the Santa Cruz phase westward movement of occupation continued at Gu Achi. This is best exemplified by Loci OO and PP, which, on the basis of ceramics, appear to be confined to the early and middle portions of the Santa Cruz phase. Beginning late in the Santa Cruz phase (around A.D. 850), settlement locations changed substantially. The westernmost and southernmost loci were generally abandoned, and 22 loci were occupied north of Locus D, several hundred meters from Gu Achi Wash. These loci are more than half of all those identified at Gu Achi.

Surprisingly, however, the total area covered by the new loci is actually less than the area occupied in earlier time periods. The new loci cover 23,610 sq. m. Including older loci that exhibit Santa Cruz/Sacaton phase material, the total still is less than 30,000 sq. m. The estimated total for the late Snaketown/Gila Butte phase deposits in Locus D is 35,000 sq. m., and for what appear to be pure Santa Cruz phase deposits (Loci HH, OO, and PP), the total area is 37,200 sq. m.

The reduction in total site area used by the transitional Santa Cruz/Sacaton phase populations should not be construed as evidence of a population decline. Rather, two factors suggest that population actually increased. First, the time period represented by the late Santa Cruz/Sacaton phase loci is probably shorter than for the other loci in question. While there is at present no way of proving it, the manifestations of the Santa Cruz/Sacaton phase transition probably lasted no longer than 2 to 4 generations, or roughly between 50-100 years. Thus, most, if not all, of the Santa Cruz/Sacaton phase loci are roughly "contemporary," which may or may not be true for the earlier loci. Second, the surface deposits of Santa Cruz/Sacaton phase age are generally much more dense than most deposits from the other time periods. This could be the product of a larger sedentary population during Santa Cruz/Sacaton phase transition; however, it could also indicate that the earlier populations were only at the site on a seasonal basis while the Santa Cruz/Sacaton phase occupants were the first group to live there year round.

This aspect brings up the role of the reservoir (Locus A) at the site. Several authors implicitly or explicitly view the use of reservoirs during this time period as the major factor that permitted year-round occupation of village sites in the Papagueria (Raab 1976; Doelle in press; Gasser Appendix A). The large reservoirs, such as at AA:5:43 (Raab 1975, 1976) and Gu Achi, should have provided a dependable source of water year round for the site occupants, and a major reason for the areal shift of loci at the beginning of the Santa Cruz/Sacaton phase transition may have been for the purpose of being closer to the water supply. However, if the premise is accepted that sedentary year-round occupation is impossible without such a feature, then it must be demonstrated that populations before the late Santa Cruz phase and later Sells phases were practicing some kind of a bilocational residence pattern. Present evidence does not support such a practice for the early populations, and while there is some support for the bilocational residence pattern in the Sells phase (see Stacy 1977 and Chapter 6), the data is weak.

At present there is no evidence on the social, political, or religious structure of Gu Achi. It has been suggested elsewhere (Masse in press a) that the Santa Cruz/Sacaton phase Hohokam sites in the San Pedro Valley may have been part of a nucleated settlement system organized at the sociopolitical level of a chiefdom. While there may be some evidence for shamanism at Gu Achi (Excavation Area 1), there is no indication that the site ever reached the levels achieved in the Gila Basin (Doyel in press) and San Pedro Valley. Because of the rich and varied artifact assemblage from Excavation Area 1, it is possible that the ramada and surrounding area were communal storage facilities, perhaps owned and operated by a "chief." However, this is pure speculation. The absence of a ball court and the lack of figurines, caches, and other items of religious or socially integrative function seem to distinguish the Papagueria from every other regional Hohokam population.

Sells Phase

The Sells phase loci at Gu Achi are almost certainly specialized agricultural sites. However, if they are indeed summer agricultural field camps, then where was (were) the parent village(s), and was it occupied seasonally or year round? I believe that sites such as Ash Hill are permanent villages from which the loci at Gu Achi are derived. This belief presupposes that the occupants of Ash Hill (or other nearby permanent villages) had access to a permanent domestic water supply, perhaps from wells in either the Santa Rosa or Gu Achi Washes during the winter months. This presupposition remains to be verified.

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Chapter 6

A CRITICAL REVIEW OF PREVIOUS ARCHEOLOGICAL WORK IN THE PAPAGUERIA

In this chapter all previous significant archeological work in the Papagueria will be summarized and critically reviewed in the light of present data. The purpose of such a review is to discuss chronologically the development of archeological method and theory in the Papagueria, especially as it concerns the Hohokam. The review will concentrate on data regarding Hohokam subsistence strategies and settlement patterns. Also, in order to understand cultural and chronological relationships better, this author has reexamined several original site collections, especially ceramic assemblages. In some instances revisions of original identifications or interpretations are suggested. While these reexaminations were not necessarily as detailed as would have been preferred, they have nonetheless helped to provide a more unified and holistic view of Papaguerian archeology than otherwise would have been possible. In Chapter 7 the major points of this review will be coupled with the data from Gu Achi in order to provide a synthesis of Papaguerian Hohokam subsistence and settlement patterns.

Archeological research in the Papagueria can be divided into five temporal/methodological periods: (1) observations of missionaries, pioneers, and travelers before 1920, (2) Gila Pueblo's survey in the late 1920's, (3) the Arizona State Museum's excavation program under the direction of Emil W. Haury between 1938 and 1942, (4) various survey and testing programs, mainly confined to the western Papagueria, from the 1940's to the early 1970's, and (5) contract research projects of the 1970's. The recentness of the 1970's contract work has precluded its integration, thus far, into a coherent regional framework. For this reason, the review of the recent work will be more exhaustive than that of work from previous periods.

Early Observations (pre-1920)

Until recently, the Papagueria has been largely ignored by Southwestern archeologists. Students of the late 1800's and early 1900's who had made a concerted effort to explore most portions of the Southwest avoided the Papagueria. Adolph Bandelier (1892) referred to the Papagueria as "dismal" and "desolate" and decided its ruins were not worth exploring as they were similar to more numerous and more accessible ruins on the lower Gila and Salt Rivers. Jesse Walter Fewkes spent some time at Santa Rosa and other historic Papago villages but was mainly interested in collecting myths and other ethnological information related to his work at Casa Grande National Monument (1906-1907; 1909). Carl Lumholtz (1912) noted several archeological sites during the course of his travels in the Papagueria and northern Sonora; however, like Fewkes, his interests focused primarily on the historic populations of these areas.

The Gila Pueblo Survey (1920's)

The first serious archeological study undertaken in the Papagueria was the Gila Pueblo survey done in the late 1920's. The purpose of the survey was to discover the route by which the "Red-on-buff" Hohokam culture had entered the Gila Basin (Gladwin and Gladwin 1929). The Gladwins were convinced that the Hohokam culture was distinct from the generalized Southwestern Pueblo culture, and they felt that the evidence from the Gila Basin pointed to a southern (Mexican) entry for these people (Gladwin and Gladwin 1928). A total of 155 sites was recorded in the area bounded by Gila Bend and Casa Grande on the north, Tucson and Nogales on the east, Caborca on the south, and Ajo on the west (Gladwin and Gladwin 1929: map facing p. 76).

The survey was neither intensive nor systematic; nevertheless, the Gladwins were able to obtain useful information concerning the archeology of the Papagueria. First, they were able to conclude that there had been no movement of Hohokam from the south to the north. Rather, the evidence suggested the opposite, and the Gladwins felt that the ". . . original tide of immigration may have come from the east, or southeast, and that some groups were diverted from the main stream and pushed west and south into the (Papagueria) . . ." (1929: 129). They further speculated that some of the Hohokam in the Papagueria may have developed directly into the group we recognize as the modern Papago. (This position is currently being vigorously debated.) Different types of sites were found in the valley bottoms than in the more mountainous areas. The mountainous areas contained rock shelters and "trincheras" (fortified hill sites) while larger sites, represented by sherd scatters and occasional mounds, were confined to the valley floors (Gladwin and Gladwin 1929: 117). The valley floor sites were always located next to washes where the potential for agriculture was high. Most sites the Gladwins encountered were thought to represent a brief and unsuccessful attempt by the Hohokam to colonize a hostile and uncompromising environment (H. Gladwin 1937: 94-95).

A curious feature found at a few of the valley floor sites, including Gu Achi, was what the Gladwins referred to as "bowl-shaped" mounds (1929: 117-118). They did not entirely understand what the function of these structures may have been but cogently observed that at least some of them were situated in locations favorable to drainage reception. Recent work has demonstrated that most, if not all, of these features are prehistoric reservoirs. It is possible that the term "bowl-shaped" mound may also have been used to describe ball courts; however, the presence of ball courts in the Papagueria has not yet been substantiated.

The site of Gu Achi was first recorded in 1929 by Frank Midvale. (At the time of the Papagueria survey, he used his family name, "Mitalsky.") Midvale, who performed much of Gila Pueblo's Papagueria survey, described three sites located five to seven miles southeast of Window Mountain (Arizona State Museum site survey files). Two of these were sherd and lithic scatters that he interpreted as possible villages while the other was termed a "stadium-shaped" mound. Midvale noted that these sites possibly merged together and, thus, were part of a single site. Recent survey by this author indicates that the two sherd and lithic scatters represent western components of Gu Achi; the "stadium-shaped" mound is undoubtedly the reservoir. Photographs taken by Midvale of the site support this conclusion (Fig. 5).

At about the same time Gila Pueblo was conducting its investigations of the Papagueria, Sauer and Brand surveyed several archeological sites in northern Sonora and the southeastern portions of the Papagueria (1931). Although their study focused primarily on "cerros de trincheras" (fortified hill sites), Sauer and Brand also discussed climate, agricultural potential, distribution of pottery types, and other aspects of regional history and prehistory that are of importance to the present study.

Arizona State Museum Excavations (1938-1942)

In 1938, the Arizona State Museum and the Department of Anthropology at the University of Arizona began a major program of study in the Papagueria under the direction of Emil W. Haury. Haury felt that this study

> . . . would not only clear up the void which existed there in the archaeological studies of Arizona as a whole, but would also provide the basis and background for projected studies of the Papago as well as paving the way for archaeological studies in northern Mexico (Haury and others 1950: 2).

While some survey was performed, the emphasis of the archeological program was on excavation since no Papaguerian site had yet been systematically tested.

The first site to be excavated was Bat Cave, located on the precipitous slopes of South Mountain at the southern end of the Quijotoa Range. The excavation of this cave, under the immediate supervision of Frederick H. Scantling, yielded 17 artifacts and nearly 20 tons of bat guano, the latter of which, by previous agreement, was given to the Papago. While the archeology of Bat Cave was disappointing, nevertheless, the good will generated by the "mining" of the guano for the Papago greatly enhanced the relationship between the Papago Tribe and the Arizona State Museum and laid the groundwork for the next four years of archeological studies on the Papago Reservation (Haury 1942: 20-21; 1978: personal communication).

The first significant excavation in the Papagueria was Scantling's (1939; 1940) work at Jackrabbit Ruin in 1938-1939. Jackrabbit Ruin (Fig. 90) is a large village seven miles east of Sells that consisted of numerous trash mounds, a platform mound, surface houses, and associated compounds, all covering an area of approximately 87,500 square meters. Excavations

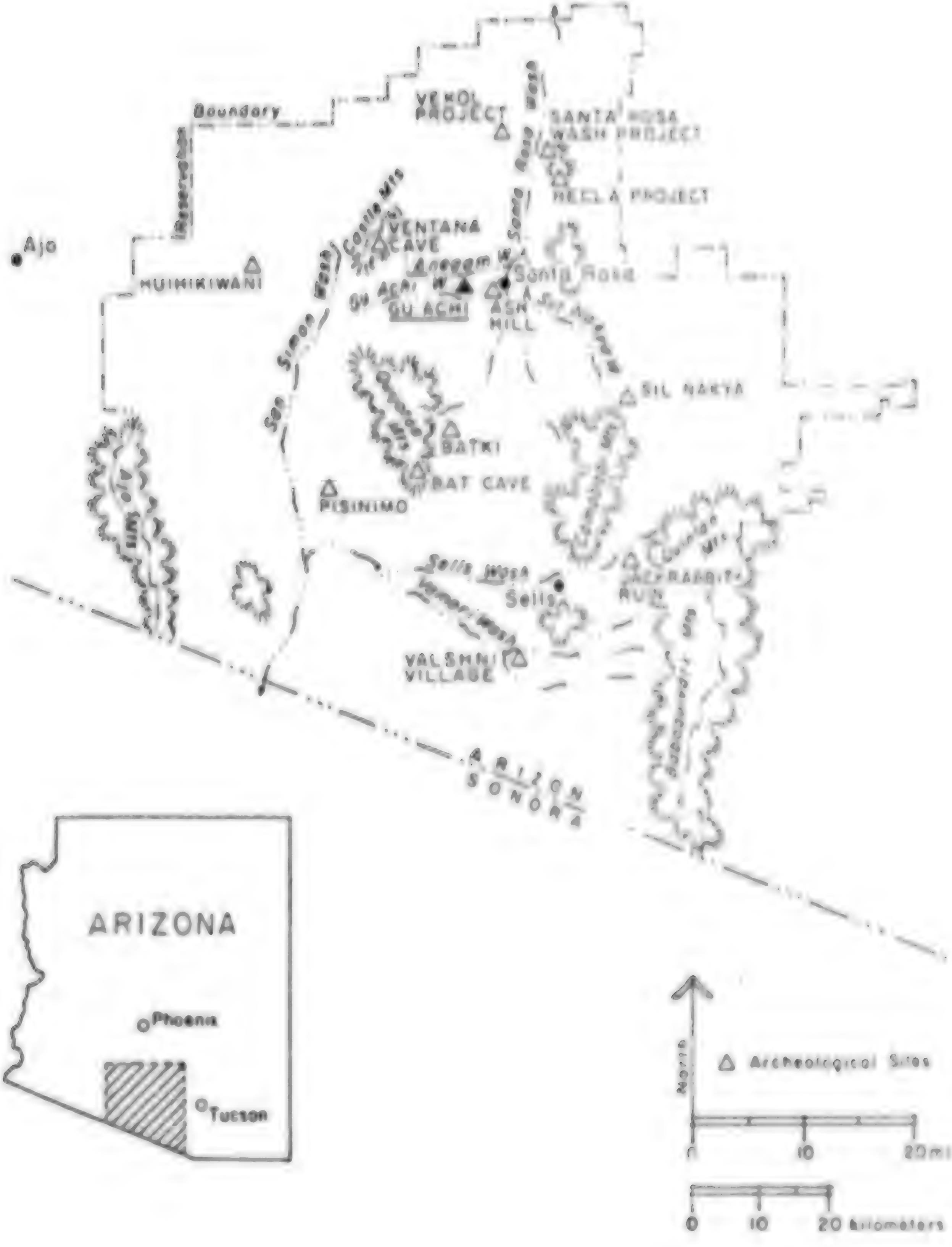

Figure 90. Map showing the location of major archeological sites in the Papagueria.

revealed that the village had been occupied during the 14th century A.D., inhumation burial was practiced, red-on-brown pottery (Tanque Verde) was the dominant type of decorated pottery, redware pottery (Sells Red) was abundantly produced, projectile points and artifacts of shell were relatively scarce, and fleshing knives (tabular or "mescal" knives) were common. Scantling felt that while the occupants of Jackrabbit Ruin were certainly influenced by the Gila-Salt Basin Hohokam, they were not Hohokam (1939: 12). Scantling called this manifestation the "Sells Phase" to distinguish, culturally and temporally, the late Classic period inhabitants of the Papagueria.

The next project undertaken by the Arizona State Museum was the excavation of Valshni Village (Fig. 90) under the direction of Arnold M. Withers (1941, 1944, 1973). This sizeable village was excavated because previous testing at the site had demonstrated the presence of substantial pre-Classic period material with the potential for extending the time depth of our knowledge of Hohokam-related populations in the Papagueria. Valshni Village contained five trash mounds and at least 28 house structures in an area of some 55,000 square meters, with occupation spanning the period A.D. 800-1250. Withers divided the occupation into two phases, Vamori (A.D. 800-1100) and Topawa (A.D. 1100-1250), based for the most part on the ceramic assemblage. A locally made decorated ware was isolated for each phase, Vamori Red-on-brown and Topawa Red-on-brown, respectively. In addition, a locally made redware, Valshni Red, was produced in small quantities during the Vamori phase and in increasingly larger quantities during the Topawa phase. Withers contended that these types evolved directly into Tanque Verde Red-on-brown and Sells Red; likewise, he argued that the Vamori phase populations evolved directly into those of the Topawa phase, and Topawa phase populations evolved directly into the Sells phase, apparently without any external disturbance (1973: 79-83). The presence of a single inhumation burial (and no cremations) and the general lack of elaborately carved pieces of stone at Valshni Village were seen as supportive evidence of the relationship between populations at pre-Classic period sites such as Valshni Village and Classic period sites such as Jackrabbit Ruin. Withers noted that the large Topawa phase house structures were uncharacteristic of the Hohokam. Like Scantling, Withers (1973: 82) felt that the occupants of Valshni Village were not Hohokam though they were greatly influenced by the Hohokam.

It is likely that Valshni Village represents a typical Hohokam settlement similar to many others founded during the transition between the Santa Cruz and Sacaton phases (Masse in press a). The reasons given by Withers (1973: 81-83) that suggest a cultural affiliation separate from either the Gila Basin Hohokam or the Trincheras culture of northern Sonora are based on inadequate data from Valshni Village and the small number of excavated Hohokam sites available for comparison in 1941. Had a larger portion of Valshni Village been excavated, cremation plots would likely have been discovered. The small amount of stonework is characteristic of all but a few large Hohokam village sites. Likewise, the large Topawa phase houses at Valshni Village that were once thought to be unique have been duplicated in the most recent excavations at Snaketown (see Haury 1976: Fig. 3.18).

The ceramics from Valshni Village are also open to re-evaluation. First, it is noted that buffware pottery was by far the dominant decorated ware throughout most, if not all, of the pre-Classic period (Withers 1973: Fig. 22). Vamori Red-on-brown, the earliest of the decorated 'Desert Branch' Hohokam pottery types, was apparently manufactured in small quantities. It was only with the appearance of Topawa Red-on-brown that red-on-buff pottery was no longer the dominant decorated ware. In other Papaguerian sites such as Gu Achi and Ventana Cave and in other peripheral regions of southern and southeastern Arizona, by the late Sedentary period buffware production (and/or importation) also dropped dramatically.

The fact that Vamori Red-on-brown has not been noted in northern Sonora (Bowen n.d.: 93) and is rare or absent in most Papaguerian sites suggests that the production of Vamori Red-on-brown was a single-site phenomenon restricted principally to Valshni Village and that it was not widely traded. This situation is not unusual, and localized ceramic traditions have been reported from other Hohokam sites (Masse n.d.a). It is further suggested that Vamori Red-on-brown is simply a variant of Rillito/early Rincon Red-on-brown of the Tucson Basin, and likewise Topawa Red-on-brown is the Papaguerian equivalent of the transitional Sedentary/Classic period type, Cortaro Red-on-brown.

The principle differences between Valshni Village and other Papaguerian Hohokam villages further to the north are (1) the apparent close and continuous contact with the Trincheras culture indicated by the presence of large numbers of Trincheras decorated ceramics, and (2) the actual percentage of decorated sherds in the total ceramic assemblage at Valshni Village is only about 3% as opposed to the figure of 10% reported from most other noncore area Hohokam sites. However, at least two other Papaguerian Hohokam sites, Pisinimo and Sil Nakya, also seem to contain relatively low percentages of decorated wares. Valshni Village displays cultural and material patterns that with little doubt can be considered Hohokam.

After the excavation of Valshni Village, the Arizona State Museum decided to concentrate its efforts on investigating the time period between A.D. 1400-1700, commonly referred to as the protohistoric period, which was then (and is now) poorly known (Haury and others 1950: 18-21). To this end, excavations were begun in 1941 at Batki (Fig. 90), a historic Papago village that had been visited by the Jesuit missionary, Father Eusebio Kino, in 1698 (Bolton 1936: 399) and that was destroyed by Apaches during the winter of 1851-1852--an event recorded on Pima and Papago calendar sticks (Russell 1908: 45; Underhill 1938: 21-23). Unfortunately, shortly after work at the site began, it was halted by a delegation of Papagos who feared that the excavations would set free the "malignant influences of the Apaches" to harm the residents of the reservation (Haury and others 1950: 20-21).

Another suitable protohistoric period site could not be located; thus, an "alternative" excavation was initiated at Ventana Cave, a large rockshelter in the Castle Mountains (Fig. 90), 10 miles west of Santa Rosa (Haury and others 1950). Excavation covered the two field seasons of 1941-1942, with Wilfred Bailey supervising the first season and Julian Hayden the second. More than 13,000 classifiable artifacts, 39 burials, and the remains of several extinct faunal species provided a record of human occupation spanning the last 10,000 years and made Ventana Cave one of the most important sites thus far reported in New World archeology (Kelley 1951: 154). Haury (Haury and others 1950) was able to define a number of pre-ceramic cultural horizons in the 4.5 m of cultural fill of the cave, including the Ventana Complex (radiocarbon dated between 9350-10,650 B.C.) (Haury and Hayden 1975: V) and three Archaic culture horizons--Ventana-Amargosa I, Chiricahua-Amargosa II, and San Pedro Cochise. The latter represented successively younger traditions that terminated around A.D. 1. Unfortunately, the material deposited in these layers had apparently been subjected to periodic moisture; thus, no perishable remains were recovered.

The most important materials found in Ventana Cave, at least for the purposes of the present report, were those from the so-called "dry midden" that constituted approximately the upper meter of fill. Material from this deposit spanned the period of time between A.D. 1 and the present, with most representing the time period between A.D. 700-1400. An important aspect of the dry midden was the presence of several normally perishable items, such as sandals, cloth, and worked wood. Ironically, the time period between A.D. 1400-1700 seemed to be poorly represented and perhaps completely absent from the deposits (see, however, Goodyear 1977a). Using the material from the dry midden of Ventana Cave and coupling it with the information previously obtained from Valshni Village and Jackrabbit Ruin, Haury identified a separate branch of the Hohokam culture, the "Desert Branch" of the Papagueria, which he distinguished from the "River Branch" of the Gila, Salt, and Santa Cruz Valleys (Haury and others 1950: 546-548). The Desert Branch, he suggested, existed between A.D. 800-1400 and was divided into three phases, Vamori, Topawa, and Sells. The following trait chart (Table 17) was used by Haury to illustrate the differences between the River Branch and the Desert Branch, especially after A.D. 1000 (Haury and others 1950: 547). In general, the differences between these Branches were postulated to be the result of adaptation to two distinctly different environments.

For nearly all of the past three decades, this bifurcation of the Hohokam culture has been accepted as doctrine by most students of Hohokam archeology. However, the evidence from Gu Achi and from AA:5:43, another large village recently excavated in the Santa Rosa Valley (Raab 1974; 1976), now suggests that this scheme should be considerably modified or even abandoned (Chapter 7; Masse in press a). The contention of direct descent from Archaic Cochise culture to the Hohokam and from the Hohokam to the historic Papago is also suspect on the basis of our present evidence. Haury has recently reversed his position and argued against an Archaic culture/Hohokam continuum (1976: 351-353); likewise, the Hohokam/Papago continuum has also been questioned (Fontana 1976; Masse 1979).

River Branch	Desert Branch
Cremation	Earth burial
Red-on-buff pottery, not polished	Red-on-brown pottery, polished
Red ware, black interiors	Redware, red interiors
Full troughed metate, well shaped	Block metate, some shaping, not troughed as a rule
Great arrays of projectile points, delicate workmanship	Limited projectile point types, few in number, workmanship inferior
Well developed carved stone	Carved stone weakly represented
Few chopping, scraping, and cutting tools	Abundance of roughly chipped chopping, scraping, and cutting tools
Slate palette	Slate palette, little used
Stone and shell jewelry, abundant and elaborate	Stone and shell jewelry, rare and simple
Figurine complex strong	Figurines, rare
Large-scale irrigation systems, drawing water from streams	Limited irrigation canals, designed to catch surface runoff
Subsistence primarily agricultural	Subsistence primarily collecting
Heavy Salado intrusion after 1300	Little affected by Salado

Table 17. Comparison of River Branch and Desert Branch Hohokam traits (from Haury and others 1950: 547).

It is of interest to note that the road from Tucson to Ventana Cave passed through the site of Gu Achi, which, then as now, is not conspicuous. Had Haury stopped at Gu Achi, the definition of the Desert Branch of the Hohokam culture may have been substantially altered (Haury 1978: personal communication).

Concurrent with the work at Ventana Cave in 1942, Hayden spent a few days testing the Sells phase village of Ash Hill, located two miles southwest of Santa Rosa and slightly more than one mile from Gu Achi (Fig. 90). Eleven earthen mounds and associated sherd and lithic scatters were noted at this site (Stacy 1974: 30). The limited testing revealed the presence of at least one pit house structure and produced a small collection of ceramics and lithics not unlike those found by Scantling (1939) at Jackrabbit Ruin.

Areal Survey and Testing Programs (1940's-early 1970's)

In 1944 and 1945, E. W. Gifford (1946) surveyed and tested several sites situated near Punta Penasco on the Gulf of California. While this area does not, technically, lie within the confines of the Papagueria, it is of possible importance because at least some of its sites may have been integrally connected with the Hohokam shell procurement and trade routes (Hayden 1972). Gifford found at least one site that contained Hohokam material culture. A more recent survey of this region by Bowen (n.d.), however, indicates that the Hohokam did not directly utilize the area.

During the winter of 1951-1952, Paul Ezell (1951-52, 1954, 1955) spent three months surveying Organ Pipe Cactus National Monument in the western portion of the Papagueria. He recorded more than 100 sites, including habitation sites, rock shelters, camp sites, quarry-workshops, and trails--ranging in time from early Archaic to recent historic. On the basis of this survey and other minor surveys conducted by him before and after his work at the National Monument, Ezell suggested that three distinct prehistoric ceramic-producing cultural traditions were present in the Western Papagueria. These were delineated by the distributions of their ceramics. "Lower Colorado Buff Ware" occurred between the present western boundary of the Papago Indian Reservation and the Colorado River, "Sonoran Brown Ware" ceramics were mostly confined to the western portion of the Papago Reservation and south into northern Sonora, and "Hohokam Buff Ware" was confined to the middle Gila River except for small enclaves in and around Organ Pipe Cactus National Monument.

In his definition of the Sonoran Brown Ware tradition Ezell combines several geographically, temporally, and possibly even culturally diverse pottery types (1954: 16). Included in this conglomeration of types are the so-called "Desert Branch" Hohokam types of Sells Plain, Sells Red, Vamori Red-on-brown, and Topawa Red-on-brown; Trincheras Purple-on-red and Trincheras Polychrome from Sonora; Tanque Verde Red-on-brown from the Tucson Basin and Papagueria; and, finally, the recent historic Papago types of Papago Plain, Papago Red-on-buff, and Papago Black-on-red. To lump these types together is to assume a close cultural relationship between the prehistoric populations of the Tucson Basin, Papagueria, and Sonora and, furthermore, to assume a continuity between these populations and the historic Papago (or at least Piman-speakers) (see Ezell 1963). While there are indications of affinities among some of these pottery types and their respective cultures, the only single unifying bond among all of them is geography--they are all found in roughly the same area. Such a relationship is weak at best and causes one to wonder about the efficacy of lumping these pottery types into a single ware. Also, Ezell oddly omits Canada del Oro Red-on-brown, Rilito Red-on-brown, and Rincon Red-on-brown, the direct antecedents of Tanque Verde Red-on-brown, from his typology.

Without going into detail, I suggest that the Sonoran Brownware Tradition (which is noted to have strong affinities with the Mogollon Brown Ware Tradition) be restructured to include the following pottery types: Canada del Oro Red-on-brown, Rillito Red-on-brown, Rincon Red-on-brown, Rincon Polychrome (Greenleaf 1975a), Rincon Red, Cortaro Red-on-brown, Tanque Verde Red-on-brown, Sells Plain, Sells Red, and Rio Rico Polychrome (Doyel 1977b). Trincheras Purple-on-red and Nogales Polychrome are related to these types, but because of coil-and-scraper thinning and some design motifs, these two types should be placed within the Mogollon Brown Ware Tradition. The "Desert Branch Hohokam" pottery types of Vamori Red-on-brown and Topawa Red-on-brown should be considered variants of Rillito/Rincon Red-on-brown and Cortaro Red-on-brown, respectively. The historic Papago, Gila River Pima, and Maricopa Indian pottery (see Fontana and others 1962) is considered a separate tradition, here named the "Piman Brownware Tradition". This restructuring creates a more consistent grouping of pottery types both in terms of manufacture and of cultural affiliation.

In 1954, Hinton surveyed a portion of the Altar Valley in Sonora, Mexico (1955). He found many large sites along the river that contained large numbers of Trincheras Purple-on-red pottery sherds and other artifacts, along with numerous concentrations of fire-cracked stone. These sites were attributed to the Trincheras culture, which he dated between A.D. 700-1200. Next to the river Hinton also encountered several sites containing few, if any, decorated sherds. He felt that these sites dated more recently than the Trincheras culture sites and believed them to be contemporaneous with the "cerros de trincheras" (fortified hill sites) found on the nearby hills. Hinton suggested that these sites may represent occupation by early Piman groups, but he did not speculate on the nature of the relationship between the occupants of these sites and the earlier Trincheras culture sites.

The first detailed testing of a northern Sonora Trincheras culture site was done by Johnson in 1959 at the La Playa site (1960; 1963). La Playa is a large site (1.5 x 2.0 miles) in a swampy cienaga area along the Rio Boquillas. Johnson pointed out many parallels between the Trincheras culture remains at La Playa and those described by Haury (Haury and others 1950) for the "Desert Branch" Hohokam. Included in his list of similarities are such things as the practice of "earth burial," a variant of red-on-brown pottery (i.e. Trincheras Purple-on-red), scarcity of figurines and carved stone, the presence of basin-shaped metates, inferior workmanship on projectile points, and the abundance of roughly worked scraping, chipping, and cutting tools (Johnson 1963: Table 1). Large amounts of shell debitage, including specimens of Glycymeris sp. that exhibited the "grinding-faceted" technique of bracelet manufacture, were found at the site (Woodward 1936; Johnson 1960). This technique was also practiced at Gu Achi and is discussed in detail by Ferg in Appendix E.

Johnson viewed the Trincheras culture as a manifestation of the "Desert Branch" of the Hohokam culture, a position earlier suggested by Haury (Haury and others 1950: 548). Certainly the dating of the La Playa site (about A.D. 800-1100) is consistent with the time when the Hohokam culture was at its peak of expansion and influence throughout southern Arizona (Masse in press a, n.d.b). However, there are several problems in interpreting the La Playa site. First, because of severe erosion at the site, stratigraphy was disturbed. Instead, interpretation was based primarily on the distribution of surface remains. Johnson noted the possibility of a late Archaic occupation at the site but then dismissed it because the Archaic materials (mainly projectile points) seemed always to co-occur with Trincheras culture artifacts. This led Johnson to surmise that these projectile point types simply represented stylistic holdovers from the Archaic period (1963: 181). However, I would suggest that an Archaic occupation did once exist at the site and that the two inhumation burials may date to this period rather than to the later ceramic-producing period. Neither burial contained any associations except for red ochre liberally sprinkled over one tightly flexed burial. Further, even though ovens and piles of fire-cracked rock were surprisingly abundant, the paucity of ceramics and lack of house remains suggested to Johnson (1960; 1963) that perhaps the La Playa site was not actually a habitation site for the Trincheras culture populations but rather served as a specialized seasonal processing area. Alternatively many of the pit ovens and other hearth-like features could be Archaic in age (see Sayles and Antevs 1941). Thus, several aspects of the Trincheras culture, especially as represented at the La Playa site, remain anomalous.

Thomas Bowen (n.d.) recently attempted a reappraisal of the Trincheras culture, as part of the 1966-67 Sonora-Sinaloa survey conducted by the Arizona State Museum under the direction of William Wasley. Bowen suggests that the Trincheras culture area can be divided into four geographic regions (coast, coast and riverine, riverine, interior) that are more or less distinct from one another in terms of cultural development. Within these geographical regions the Trincheras culture evolved out of an Archaic Cochise culture base. During the initial stage of cultural development the Trincheras culture appears to have remained distinct from neighboring populations such as the Hohokam. Bowen refers to this period as the "Isolationist Stage." Sometime after A.D. 800 the Trincheras culture began to receive certain traits and influences from the hohokam culture (the "Receptive Stage") and after A.D. 1300, from the Casas Grandes culture (see DiPeso 1974). The latter is termed the "late Stage" and occurs only in riverine areas. Table 18 synoptically presents the differential growth of Trincheras cultural stages between the four geographical regions.

Few diagnostic traits are shared by the Trincheras culture and the Hohokam. Cremation burial and an extensive use of marine shell are shared; however, even in these traits there are considerable differences. Few mortuary offerings are present with Trincheras culture cremations, and shell manufacture techniques vary between the Hohokam and Trincheras cultures. Ball courts are lacking and trash mounds are rare in northern Sonora. Items such as paint palettes, finely made serrated cremation projectile points, three-quarter groove axes, copper bells, pottery censers and figurines are either rare or absent, and when present must be considered intrusive.

	GEOGRAPHIC REGION			
ESTIMATED INITIAL DATE	RIVERINE	COAST AND RIVERINE	COAST	INTERIOR
	Cochise			Cochise
300 B.C.				
		Isolationist	Isolationist	Isolationist
A.D. 800				
	Receptive	Receptive		Receptive?
A.D. 1300				
	Late			

Table 18. Correlation of Trincheras cultural stages with geographic regions and estimated initial dates (from Bowen n.d.: 140).

Trincheras pottery types are also markedly different from the Hohokam (Bowen n.d.). A significant distinction is that Trincheras wares are manufactured by the coil-and-scrape method rather than by paddle and anvil. A Trincheras trait foreign to Hohokam-related pottery is the presence of deeply scored interiors, which occurs in more than half of all decorated jars and in a sizeable percentage of plainware jars. Design styles are usually rectilinear, with only occasional curvilinear scrolls and squiggles. Lifeforms and repeated elements are not utilized. Polishing over the decorations also differs from Hohokam ceramic technology, with the exception of Tucson Basin red-on-brown pottery types. Both plainware and decorated vessel shapes are much more restricted for the Trincheras than for the Hohokam. Decorated ware consists of "Jars with flaring rims, rounded shoulders and bases; bowls with straight or slightly incurving sides and rounded bases; seed jars" (Johnson 1960: 63). Plainware has just one additional shape, jars with long straight necks and direct rims. Noticeably lacking are jars with Gila shoulders, scoops, outflaring bowls, censers and other typical Hohokam forms. One decorated Trincheras type, Nogales Polychrome, occurs only in bowl form and is notable because of its thick, white interior slip. The characteristics of this particular type parallel that of the Dragoon type

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Cerros Red-on-white (Sayles 1945) and the Mogollon type Three Circle Red-on-white (Haury 1936).

There is no question that Trincheras ceramics are intimately related to those of the Mogollon culture, and the designation of an "Altar Series" within the Mogollon Brown Ware tradition is probably justified (see Colton 1965). The one notable departure of the Trincheras ceramic complex from that of the Mogollon is the lack of a locally made redware; in fact, even intrusive redwares are extremely rare in the Trincheras culture area. DiPeso (1956) has reported a Trincheras-related redware at Paloparado, but this type does not seem to appear elsewhere in northern Sonora and southern Arizona (Bowen n.d.).

Beginning in the late 1950's, Julian Hayden, who had assisted Haury in the excavation of Ventana Cave, began a comprehensive survey of archeological manifestations in the Sierra Pinacate of northern Sonora. This is a rugged, desolate, 600-square-mile volcanic area some 50 miles southwest of Ajo. The northern fringe of the Sierra Pinacate, near the International Border, was historically traversed by the "Camino del Diablo" (Devil's Highway) mentioned earlier.

Hayden's continuing study has resulted in the discovery of a number of sites ranging in age from possibly Early Man (before 8000 B.C.) to recent historic Sand Papago ("Arenenos") of the late 19th century. These findings have been summarized in several articles (Hayden 1967; 1970; 1972; 1976). There are perhaps serious problems in regard to his earliest cultural horizons, which he dates to more than 40,000 years ago (Hayden 1976), but these considerations fall outside the realm of the present paper. Of concern here are Hayden's observations about "tinajas" (natural water tanks) in the Sierra Pinacate and about Hohokam "camp sites" in the western Papagueria (Hayden 1972). Hayden noted that two tinajas in the Sierra Pinacate had associated petroglyph assemblages of probable Hohokam origin, along with a few scattered sherds of Sacaton Red-on-buff. A motif repeated in the petroglyph assemblages at one tinaja seems to depict a valve of either cardium or pecten. Hayden hypothesized that these tinajas were water holes used by the Hohokam during shell-gathering expeditions to the Gulf of California and indicated that Sedentary and Classic period Hohokam sites in the western Papagueria, such as Lost City and Charley Bell Well in the Growler Valley, were seasonal camp sites along the shell procurement routes. Among the many petroglyphs at Charley Bell Well are several more examples of the shell motif; shell debitage was also abundant at the sites. Hayden used the location of these and other known sites in the western Papagueria to trace shell expedition trails to the Gila Bend region and the Gila Valley (1972: Fig. 5). His hypothesis that the shell that reached the middle Gila River Valley settlements, such as Snaketown, was transported via the Santa Rosa Valley is important here.

There is no doubt that shell procurement and trade were important to the Hohokam and that expeditions frequently went to the Gulf of California in search of shell. However, a simplistic picture may have been drawn of the nature of Hohokam settlements in the Papagueria, a point that will be further elaborated in the discussion of Fontana's (1965) work in the Cabeza Prieta Game Range.

In his 1970 article, Hayden considered several general aspects of Hohokam culture. Like Haury (1976), Hayden saw the Hohokam (a Piman-speaking group) migrating from Mexico into the Gila Valley where they displaced the local late Archaic period Amargosan populations (who were also Piman speakers) and began immediately to exchange goods and ideas with their Amargosan neighbors. The Amargosans borrowed heavily from the Hohokam but developed their own ceramic traditions (that is, the previously described Sonoran Brown Ware). Hayden suggested that the term "Hohokam" be applied only to the red-on-buff pottery-producing people of the Gila Valley (Beginning in the Vahki phase of the Pioneer period). The red-on-brown pottery-producing people of the Papagueria, Santa Cruz Valley, and San Pedro Valley (Amargosans all) are referred to by the term "Ootam." Hayden used this term in the same sense as DiPeso's original definition (1956) though Hayden was quick to point out his disagreement with DiPeso's chronological reconstruction (Hayden 1970: 92-93). Hayden clearly implies, then, that there are ethnic and cultural differences between the Ootam of the Papagueria, San Pedro Valley, and Santa Cruz Valley, and the Hohokam of the Gila Valley though all are Piman speakers. Hayden even talks about contemporaneous Sedentary period Hohokam and Ootam villages existing side-by-side just north of the Tucson Basin (1976: 90). However, this interpretation may result from sampling error, and the Ootam vs. Hohokam dichotomy, like Haury's distinction between the Desert and River Branches of the Hohokam, still needs a wider data base for substantiation.

In the fall of 1962, Fontana (1965) conducted a brief but intensive survey of the Cabeza Prieta Game Range, a large Federal game preserve contiguous to the western boundary of Organ Pipe Cactus National Monument. He found much the same type and range of material as did Ezell at Organ Pipe Cactus National Monument--everything from Archaic to historic Indian and Anglo sites. Two sites deserve special mention because of their Hohokam affiliations, Charley Bell Well and Lost City. The "Charley Bell Well Hohokam Village" site is located on the eastern side of the Growler Valley (Fontana 1965: 22-30). The shell motifs of Hohokam petroglyph assemblage at this site were mentioned above. Several rectangular surface structures of probable Classic period age and specimens of Classic period Tanque Verde Red-on-brown pottery were also present. A sizeable amount of pre-Classic period Hohokam pottery, including Sacaton and Santa Cruz Red-on-buff, was found, suggesting to Fontana that the village dated from early in the Classic period. As few sites (if any) in the Papagueria bridge the transition from the Sedentary to the Classic period, this site bears closer scrutiny in the future. However, it is possible that the pre-Classic material could be separated by a temporal and perhaps a cultural hiatus from the Classic period manifestations.

Even more important than the Charley Bell Well site is the large and complex site of "Lost City" in the middle of the Growler Valley, some 15 miles to the south. This site was originally recorded by Frank Midvale for Gila Pueblo in 1928 (H:12:1, Gila Pueblo Survey Records, Arizona State Museum, Tucson). Midvale described the site as a village with a "Sun Temple"-like structure, located near the center of the "fertile plains" of Growler Valley. Artifactual material was abundant over an area of 120 by 400 feet (4460 sq. m.), with occasional sherds found more than 1000 feet away. The "Sun Temple" was depicted as a low circular structure with "walls spread out"; its dimensions were 34 x 28 m and a maximum height of 38 cm above the surrounding plain. There was an opening to the southwest. Approximately

1 mile north of this structure was another smaller "Sun Temple"-like structure that measured 15 m in diameter, 56 cm in maximum height, and had an opening to the south (Gila Pueblo H:12:2). These two structures seem to be reservoirs, and the cultural manifestations in general appear similar to those of Gu Achi. The fact that such features were called "Sun Temples" in 1928 and "stadium-shaped" mounds in 1929 (at Gu Achi and at Gila Pueblo I:13:4 south of Ajo) is curious. This may well represent an initial attempt to differentiate morphologically between ballcourts (i.e., "sun temples") and reservoirs (i.e., "stadium-shaped" mounds) even though functions of these features were still unknown.

Lost City was reexamined by Haury in 1937 (Y:12:1 and Y:12:2 (ASM), Arizona State Museum site survey files, Tucson). He found a small trash mound of undetermined age and, approximately one mile to the north, a barren creosote-dotted plain covered with clusters of hearth stones. In this area he encountered abundant ceramics, shell, and manos; chipped stone was rare. Haury noted evidence of numerous cremations and the presence of a small, low, adobe mound, which he interpreted as a possible house mound. He did not locate either of the "Sun Temple" features reported by Midvale. However, it is likely that the possible house mound noted by Haury is the smaller of Midvale's two reservoirs.

Fontana's 1965 report discusses several other surveys and a test excavation done at Lost City before his work in 1962. Apparently, in 1933 Edward Spicer and Byron Cummings of the University of Arizona tested unknown portions of the site with negative results. Haury noted the presence of "pot hunter excavations in the main mound" during his 1937 survey. If the "main mound" mentioned by Haury was actually a reservoir and if it represents the area tested by Spicer and Cummings, this could explain the lack of cultural material encountered in the 1933 testing.

Paul Ezell visited Lost City in 1948 but failed to find much in the way of cultural remains. This situation prompted Fontana to state that Ezell's survey most likely only touched the eastern periphery of the site and simply missed the areas of major concentration. Supernaugh and Leding viewed the site in 1952, and, while finding abundant remains, did not encounter the features described by either Midvale or Haury.

Fontana's survey of the site revealed abundant cultural remains dating from the Sedentary and Classic periods. Ceramics included Gila Polychrome, Sacaton Red-on-buff, redwares, and plainwares, Tanque Verde Red-on-brown, and what Fontana termed a "degenerate derivative" of Tanque Verde Red-on-brown. Fontana's perception of the nature of Lost City is interesting, and a lengthy quote from his unpublished report is of great value here for its view of Hohokam settlement and subsistence patterns:

> As mentioned above, the eastern edge of the Lost City is characterized by scanty pottery and shell remains. There are, however, innumerable fire-cracked stone accumulations here, all of these, no doubt, the remains of fire hearths. There are perhaps two or three dozen such hearths visible, and it is possible these were firing areas once used to roast *Agave* hearts. *Agave* may once have grown in abundance on the western slope of the nearby Growler Mountains.
>
> These hearths are peculiar in that virtually no bases or bits of charcoal remain in them. This may easily be explained, however, by pointing out that the situation of the Lost City subjects it to considerable sheet flooding during the area's infrequent rains. Several hundred years of such periodic flooding would long ago have washed away all but the heavy stones from these hearths.
>
> No mounds were visible on the site when we visited here in 1962. The few holes that pot-hunters and others have dug indicate that the cultural deposit on the site is generally shallow; usually a little less than a half-meter in depth. Neither trash mounds nor house mounds are apparent, and we saw nothing in 1962 that would have led Midvale in 1928 to have talked about a "Sun Temple-like" structure. The site gives every appearance of having been used as a large seasonal campground for a long period of time, perhaps for as long as two or three hundred years. The superabundance of shell, and especially the abundance of inner cores of *Glycymeris*, suggests strongly that the people who stayed here had been gathering shell in wholesale quantities from the Gulf of California, that they had brought it to this spot to "rough it out" in a preliminary fashion, and that they then proceeded northward to the Gila River--probably via the nearby Charley Bell Well Hohokam Village--carrying bracelet blanks, other shell jewelry-making material, and probably salt. The fact that the nearest permanent water source is today about twelve miles away, as it may well have been in A.D. 1100-1200, further suggests that the Lost City was never

> a permanent habitation and that it was occupied only during the rainy seasons of the year.
>
> It is, of course, possible that a few hundred years ago there may have been closer permanent water sources than there are today, and it is possible there are remains of some houses in the site. If there are houses, they would almost surely have to be pit-houses, and therefore not easy to see from the present ground surface (1965: 54-60).
>
> In any case, 'Lost City' is a misnomer for this important Hohokam site. In nature it is much like the "La Playa" site of northern Sonora (see Johnson 1963). It certainly was not a "city" and obviously it is not, and never has been, "lost" (1965: 67).

It is obvious from the various descriptions of Lost City that many discrepancies exist in the reporting of 34 years of survey work at the site. The most acute problem is the fact that the earliest observers reported reservoirs and mounds while other observers have more recently noted the lack of such features. There are two possible explanations for this phenomenon. Fontana stated that the physical situation of Lost City is subject to tremendous amounts of sheet flooding. Julian Hayden, who has noted the effects of erosion in the valleys of the western Papagueria over the course of many years, has suggested that the features noted by Midvale and [illegible] may simply have been destroyed by this process (Hayden 1978: personal communication). Certainly degradation processes have greatly affected [illegible], as previously indicated.

The other explanation for the lack of these features, one which I am more inclined to accept, is that the floor of Growler Valley contains many areas of cultural manifestations, and each surveyor viewed somewhat different areas. In this regard, Supernaugh and Leding cogently stated in [illegible] that:

> . . . the Lost City refers to an area which contains several sites, perhaps separated by distances of only a mile or so. Which one is properly designated as the "Lost City" is problematical. . . (quoted in Fontana 1965: 63).

Midvale was a perceptive archeologist whose circumspect documentation of archeological resources was among the best of his time. I believe that there are Hohokam villages and reservoirs in the Growler Valley, probably dating as early as the transition between the Colonial and Sedentary periods. These were not temporary or seasonal campsites owing their existence to shell trade, but, like Gu Achi, were permanent villages whose populations were dependent on agricultural products as well as wild plant and animal resources.

V.K. Pheriba Stacy performed an interesting study of "cerros de trincheras" (not to be confused with the previously mentioned "Trincheras culture") sites which appeared as her dissertation in 1974 (1974; 1977). Stacy intensively studied five "fortified hill sites" in the Baboquivari Valley of the eastern Papagueria. The "cerros de trincheras" in the Baboquivari Valley are isolated volcanic hills with long rock walls and terraces on their slopes and numerous small circular structures at their summits. Contemporaneous habitation sites present at the base of the hill suggest articulation in some integral manner with the "cerros de trincheras." The paucity of cultural material on the volcanic hills themselves suggested to Stacy that their usage was limited to temporary or intermittent visits by the inhabitants of these nearby villages. The presence of sherds of Tanque Verde Red-on-brown at the "cerros de trincheras" and both Tanque Verde Red-on-brown and Sells Red at the village sites indicated an occupation during the Sells phase, which Stacy dated at A.D. 1250-1400.

Stacy explored several alternatives as to the function of "cerros de trincheras." Most plausible were the use of the rock walls for retaining special agricultural plots and their use for defense or as a refuge during times of war. Limited pollen testing of the soil behind three rock walls failed to substantiate an agricultural usage. Many of the rock walls seem to reflect a defensive posture (see also Greenleaf 1975b); in addition, the Papagos have a widespread and persistent oral tradition that attributes a defensive or refuge function to these features (Stacy 1974: 201-202). In support of these conclusions, an intensive examination of Tumamoc Hill, a "cerro de trincheras" in Tucson, has been recently accomplished by the Arizona Archaeological and Historical Society (Hartmann in press). Their findings argue strongly for a defensive rather than an agricultural function for that particular site (Wilcox in press; Masse in press b).

Two aspects of Stacy's study have considerable bearing on a discussion of Hohokam development in the Papagueria. First is her belief that the historic Papago bilocational residence pattern, in which summers are spent in valley floor field villages and winters in upper bajada well villages, is applicable to the prehistoric Sells phase populations (1974: 185; 1977: 15-16). Stacy identifies a number of Sells phase villages located in the valley floors (that is, field villages) and on upper bajadas (that is, well villages). While the Sells phase evidence for this bilocational residence pattern is by no means conclusive, the present data certainly, at least, suggest such a pattern. Stacy does not discuss the pre-Classic period settlement pattern, but nearly all, if not all, major pre-Classic habitation sites are located solely in valley floors. This suggests a radical shift in settlement (and possibly subsistence) practices between the Sedentary and Classic periods.

The second aspect of Stacy's study that is important here is the sudden appearance of "cerros de trincheras" in the Papagueria during the early portions of the Classic period (around A.D. 1200). The evidence from Tumamoc Hill further suggests that construction of some "cerros de trincheras" may have begun as early as the latter portions of the Sedentary period (about A.D. 1150-1200) (Hartmann in press). It is hardly coincidental that these sites were established shortly after a time of either population relocation or even emigration of most pre-Classic period Hohokam inhabitants from the Papagueria. Rather, the evidence strongly suggests that conflict (internecine or otherwise) or the fear of conflict may have been responsible, in part, for these significant demographic changes.

Contract Research Projects (1970's)

The 1970's ushered in a new era of studies in the Papagueria. Within a few years' span several important pieces of Federal legislation that have had a profound effect on the course of American archeology were enacted. This legislation (specifically, the National Historic Preservation Act of 1966, the National Environmental Policy Act of 1969, and Executive Order 11593) gave a mandate to Federal agencies to inventory cultural resources that would be affected by construction activities and to preserve significant resources either by avoidance or through suitable mapping, testing, and excavation programs (see for example, Scovill, Gordon, and Anderson 1977).

As a result of this legislation the number of surveys, testing, and excavation projects throughout the Papagueria has increased dramatically as new roads, powerlines, mining leases, damsites, and other projects are developed. Limitations of time and money and the difficulties of selecting field crews and training them in the specific problem area under study have sometimes affected the quality of the archeological research. Also, the reports of this research have most often been particularistic in approach and limited in scope.

Despite these limitations, the benefits of contract archeology far outweigh the drawbacks. Had it not been for the advent of contract research, large portions of the Papagueria would still be unsampled, and many types of sites previously thought to be unimportant would not have been investigated. In addition, the disadvantage of a time limit for producing a report is balanced by the advantage of making the information available to others much sooner than when unlimited amounts of time were available to authors. Nearly all the data used in this reappraisal of Papaguerian archeology have resulted from contract research projects.

It is emphasized here that each of the projects reviewed here has already made important contributions to Papaguerian archeology. Many of these projects were beset by the same kinds of frustrating logistical problems noted in Chapter 2 for Gu Achi. In fact, several of these projects were carried through to fruition only because of the initiative and sacrifice of the individuals involved. The purpose of this review is not to be overly critical of these projects, but rather to provide the framework for the synthesis attempted in Chapter 7 and to point out new directions for future research.

The discussion of contract research in the Papagueria is divided into three sections. The first section concerns several projects accomplished in the northern Santa Rosa Valley. Three major projects, the Tat Momolikot Dam and Lake St. Clair project (Santa Rosa Wash Project), the Hecla Mine project, and the Vaiva Vo-Kohatk road project, are detailed at length because of their proximity to Gu Achi and because together they represent the most intensively studied portion of the Papagueria. The second section discusses the survey and testing program performed throughout the Papago Indian Reservation by the Western Archeological Center (formerly the Arizona Archeological Center) for the Bureau of Indian Affairs, Phoenix Area Office, Branch of Roads. The work at Gu Achi was part of this program. The third and final section on contract research reviews several small projects accomplished, principally by the Arizona State Museum, in several portions of the Papagueria.

Northern Santa Rosa Valley Projects

Tat Momolikot Dam and Lake St. Clair (The Santa Rosa Wash Project)

In 1970 the Arizona State Museum partially surveyed portions of the proposed Tat Momolikot Dam and Lake St. Clair in the Santa Rosa Valley, approximately 15 miles north of the village of Santa Rosa (Fig. 90). This survey, sponsored by the Army Corps of Engineers, located 11 prehistoric sites and one historic site (Stacy and Palm 1970). While the survey was not comprehensive, it demonstrated that a more detailed survey and testing program was necessary.

In the summer of 1972, a more comprehensive survey of the complete project area was undertaken by the Arizona State Museum (Canouts, Germeshausen, and Larkin 1972; Canouts 1977). This survey recorded 38 additional sites in the project area. These were classified into five groups or "problem domains"--trails, lithic scatters, sherd and lithic scatters, historic Papago villages ("Tat Momolikot series"), and historic mining and related activities. Three sites recorded in the initial survey were tested. The 1972 survey demonstrated that a variety of cultural resources existed in the project area, and the creation of problem domains helped to focus attention on particular research problems and questions. The study also explored the interplay between environment and cultural resources more thoroughly than most of the earlier Papaguerian archeological projects.

Although the problem domains defined in the 1972 survey ". . . were constructed on the basis of geographic, chronological, and material cultural relationship in the archeological record" (Canouts 1977: 136), it is possible that three of the problem domains (trails, lithic scatters, and sherd and lithic scatters) arbitrarily lumped together sites that represent many different activities, time periods, and cultures. In addition the nature and significance of sites placed in the "sherd and lithic scatter" domain appear to have been uniformly underestimated. For example, two of the largest sites in the area, AA:5:43 and AA:5:30, contain dense concentrations of diverse types of cultural material, including substantial trash mounds at one of the sites, but, at the time of survey, neither site was explicitly recognized as a village.

An extensive mitigation program for the Tat Momolikot Dam and Lake St. Clair project (hereafter referred to as the "Santa Rosa Wash Project") was performed in 1973 by L. Mark Raab (1973, 1974, 1975, 1976, 1977). Raab's work indicates that the 1972 survey was not comprehensive, as his resurvey located and recorded 197 sites in the 33 square miles of project area (1976: 232; elsewhere Raab [1977: 171] states the total as 183). The discrepancy between the 1972 and 1973 surveys may be due to unfamiliarity with the nature of archeological sites in the Sonoran Desert on the part of members of the original survey crew or to the tacit assumption made by some archeologists "that creosote flats indicate an ecological zone of extreme aridity and negligible resource potential for primitive people, leaving these areas examined very little or not at all" (Raab 1976: 127).

The prehistoric sites studied by Raab include large pre-Classic Hohokam villages in the floodplain of Santa Rosa Wash (Fig. 90) as well as small Sells phase "cactus camps" (cactus fruit processing sites) on the slopes of the Slate Mountains. One village, AA:5:43, is similar to Gu Achi, though on a somewhat smaller scale. Here, eight distinct concentrations of cultural material ("loci") were scattered on the surface of an area of "over a square mile" (Canouts and others 1972: 118) in the western floodplain of Santa Rosa Wash. Raab does not define the actual limits of the "site," but a rough map (1976: Fig. 4) suggests that the eight loci occupy an area substantially smaller than a square mile; in fact, each locus is treated as a separate site in Raab's discussion. The features found in the eight loci include at least five trash mounds, a reservoir, two pit houses, a ramada, occupation surfaces, numerous hearths and pits, and miscellaneous trash deposits.

The five trash mounds were similar in size and apparent composition to the trash mound (Locus G) at Gu Achi. They ranged in shape and size from circular structures approximately 8 m in diameter and up to 30 cm in height to elongated structures between 10-20 m in width, 17-33 m in length, and as much as 40 cm in height. Raab also encountered several flat, densely packed trash deposits (such as Loci J, K, and T at Gu Achi) that he suspected were deflated trash mounds.

The reservoir at AA:5:43 is nearly identical to the one at Gu Achi except that it is somewhat larger and contains a specialized detached embankment that probably separated the hypothesized inlet and outlet channels (see Raab 1975). While the outside diameter of the reservoir is 75 m, about 19 m greater than the one at Gu Achi, the interior dimension of 30-35 m is roughly comparable to Gu Achi's. Trenching of the reservoir at AA:5:43 reached a depth of more than 4 m below the present ground surface; the bottom of the reservoir was never reached because of safety precautions. Excavation of an area (30 m)^2 and 4 m in depth required the removal of 3600 m^3 of soil. This task is nearly comparable to the construction of the large Snaketown-style ball court at Snaketown where embankments were estimated to contain 4000 m^3 of soil (Haury 1976: 78). Even if the actual volume of soil removed from the reservoir was less than 3600 m^3, its construction still represents a sizeable endeavor.

The extramural hearths at AA:5:43 were similar to those at Gu Achi. Large hearths with numerous fire-cracked stone and smaller cobble-free hearths were found. Extramural pits at AA:5:43 are generally small and shallow, and some may have served as pot rests, like those at Gu Achi. The supposed ramada in Locus 1 resembles the one at Gu Achi except that rings of stones support the posts.

The pit house in Locus 1 is similar to Sacaton phase structures at Snaketown (for example, Haury 1976: Figs. 3.13h (House 6:5G), 3.14a). This pit house measures 3 x 5 m and was excavated to a depth approximately 15 cm below the ground surface. No peripheral post holes were found, but the interior floor of the structure was ringed with post holes. These indicate a substantial secondary post roof support. A radiocarbon sample obtained from a charred post yielded a date of A.D. 1000. The second pit house at AA:5:43, also dated around A.D. 1000 on the basis of ceramics, is unusual in shape. It is extremely small and squarish, being only 2.5 m on a side (approximately 6.25 sq. m). The ramp entryway is in a corner of the structure rather than in the middle of one of the sides, a most unusual situation for Hohokam pit houses.

The occupation of AA:5:43 was dated at approximately A.D. 1000 on the basis of ceramics and two radiocarbon dates. Raab noted that many of the red-on-buff ceramics at AA:5:43 were consistently transitional between the Santa Cruz and Sacaton phases, which he dated at A.D. 1000. This date may be somewhat too late and most likely reflects the end of the pre-Classic period occupation at AA:5:43 rather than the time of peak occupancy. A time range of A.D. 850-1000 appears to be more in line with our present data (Masse in press a, n.d.b). Raab also noted the presence of small numbers of sherds that he felt were diagnostic of the Sells phase, indicating a reoccupation of the site in the Classic period. Reexamination of the ceramics by this author suggests that at least some of the Classic period sherds date to the Sacaton phase. Bowl sherds originally identified as Casa Grande Red-on-buff are Sacaton Red-on-buff. Likewise, what was originally identified as Sells Red may be a local variant of Sacaton Red. This reassessment appears more harmonious with the rest of the cultural assemblage from this locus, including the radiocarbon date of A.D 1000 ± 60 from the pit house in Locus 1.

By adjusting Raab's dating scheme, the striking resemblance of this site to presumed contemporary portions of Gu Achi is further emphasized. All of the cultural features mentioned above are duplicated at Gu Achi.

AA:5:30, one of the largest sites investigated by Raab, lies a mile north of AA:5:43 in the eastern flood plain of Santa Rosa Wash. AA:5:30 covers an area of more than 112,000 sq. m (including non-cultural areas between artifact concentrations). Nine sherd and lithic concentrations were noted as the only visible surface features. Raab suggested these were eroding trash "deposits" (mounds?). No excavations were attempted at this site. Instead, trash deposits were nearly totally surface collected, and a systematic random sample was taken from areas between the deposits.

AA:5:30 contained large quantities of red-on-buff ceramics dating from the Snaketown and Gila Butte phases and smaller numbers of Santa Cruz and Sacaton phase ceramics. Because of the Snaketown Red-on-buff ceramics, Raab suggested that the occupancy of the site may have begun as early as A.D. 350, the estimated initial date of manufacture of this pottery type at Snaketown (Haury 1976: 215). Recent personal examination of these ceramic collections indicates to me that the initial occupation of AA:5:30 most likely occurred somewhat later (about A.D. 500). A number of stylistically late design elements on the Snaketown Red-on-buff pottery provide the basis of this dating. Such a temporal refinement accords with data from other early Hohokam sites in southern Arizona, including Gu Achi.

A third significant site, AA:5:54 ("Field Number 28"), was located in the western portion of the Santa Rosa Wash flood plain. This was a large multiple component site covering more than 1,000,000 sq. m; however, the area actually covered by cultural remains is probably much less than this figure. At least two temporal components were noted. The first component appears to represent a major Classic period village. Four major trash mounds were noted, and several smaller artifact concentrations may also represent small deflated trash mounds. No houses are visible on the surface of the site, but this is typical of Classic period southern Arizona sites where masonry was not incorporated into house construction (see Scantling 1940; Doyel 1974). The extent of the site and the presence of the large trash mounds indicate that AA:5:54 was a sizeable village.

In testing one of the large trash mounds, Raab (1974) found Classic period ceramics, including Casa Grande Red-on-buff, Tanque Verde Red-on-brown, Gila Polychrome (post-A.D. 1300 Salado pottery type), Salt Red, Gila Red, and possibly Sacaton Red-on-buff. A brief personal examination of this pottery suggests that some of the sherds identified as Tanque Verde Red-on-brown may be of the transitional Sedentary/Classic period type Cortaro Red-on-brown (Kelly 1978: 47-48; Karl J. Reinhard and Linda M. Gregonis 1978: personal communication). Cortaro Red-on-brown is comparable in both age and treatment to the Topawa Red-on-brown described by Withers (1941) at Vaishni Village. Thus, AA:5:54 may be an important site for future research on the problem of the relationship between Sedentary and Classic period populations.

The second component of AA:5:54 is a reservoir with an outside diameter of 33 m and embankments up to 1 m in height. This small reservoir is located astride a branch of Kohatk Wash at an unstated distance south of the trash mounds. Uncharacteristically, although this feature most likely dates to the transition between the Santa Cruz and Sacaton phases, it appears to be isolated from other contemporaneous pre-Classic activity areas. The map of the Santa Rosa Wash Project area (Raab 1976: Fig. 4) shows no sites within a mile to the north and east of AA:5:54 or within 1/2 mile and 1/4 mile to the south and west, respectively. The last two figures represent the boundary of the survey area; thus, pre-Classic sites in those directions could be further removed. Other known Papaguerian reservoirs (Ou Achi, AA:5:43, Lost City, and Gila Pueblo's I:13:4 in the Ajo Valley) are associated with what appear to be substantial Santa Cruz/Sacaton phase villages. However, neither the excavation of the trash mound at AA:5:54 nor the survey of the site revealed any ceramics earlier than the late Sedentary period.

While Pumpelly (1918) has observed that the historic Papago were willing to travel many miles to obtain their water (see Chapter 2, this volume), it is logically difficult to perceive why the Hohokam would go to the trouble of building such a structure so far from a village. I suspect that an associated pre-Classic period village is present but is buried in the valley floor sediments. However, other alternatives are possible. It may be that the reservoir at AA:5:54 was built as a reserve domestic water supply for a distant village, such as AA:5:43 (one mile to the northeast), to help out during the periods of drought; it may have provided a domestic water supply for people farming the surrounding area; or perhaps water was channeled or hand carried from the reservoir for use on the crops.

Using a series of vegetation transects, Raab divided the Santa Rosa Wash Project survey area into three major vegetation zones. Zone 1 was the immediate floodplain around Santa Rosa Wash, dominated by mesquite (*Prosopis juliflora*) and saltbush (*Atriplex* sp.). Zone 2 comprised the bajada tops and the lower flanks of the Slate Mountains. In this zone ironwood (*Olneya* tesota) and paloverde (Cercidium microphyllum) prevailed over mesquite. Likewise, cacti were found in greater numbers in Zone 2 than in the other zones, and Raab subdivided Zone 2 on the basis of numbers of cacti. Zone 2a consisted of the mountain flanks and rockier bajada tops that contained greater numbers of cacti (except for hedgehog (Echinocereus sp.)) than Zone 2b. Zone 2b contained the less rocky bajada tops. Zone 3, like Zone 1, was located on the Santa Rosa Wash floodplain but away from the wash itself. Zone 3 was dominated by creosote (Larrea divaricata) almost to the exclusion of any other plant species.

A major goal of Raab's research was to correlate site types with their physical surroundings in order to explain demography and the nature of the prehistoric settlement system in this portion of the Santa Rosa Valley. He identified three components of the settlement system, corresponding to the previously outlined vegetational zones. A Floodplain Village Component in Vegetational Zone 1 consisted of domiciliary village sites, such as AA:5:44 and AA:5:30, situated near the wash to use the riparian resources (water, mesquite, annual grasses and herbs, and associated faunal populations). Raab did not exclude the possibility of agriculture but felt that most farming was done in the Agricultural Component. The Agricultural Component, in vegetational zone 3, contained many small (less than 10,000 sq. m) sherd and lithic scatters that Raab interpreted as sites directly related to agricultural pursuits. Although some of these sites were quite large and "relatively permanent," Raab (1976: 236) implied that they were occupied only seasonally. The Mountain Component (vegetation Zone 2) contained numerous small sites that Raab interpreted as the residue from seasonal exploitation of cactus fruit (see also Raab 1973a), leguminous seeds (mesquite, paloverde, and ironwood beans), and possibly wood resources. The Mountain Component also provided sources of lithic material and locales for deer hunting. Sites in the Mountain Component varied from small lithic scatters related to quarrying or plant processing activities to cactus fruit processing camps where sherds, lithics, and ground stone artifacts were found in large numbers. Small rings of cobbles, measuring less than 1 m in diameter, were encountered at some of the saguaro fruit processing sites. These were found in both prehistoric and historic proveniences and have been interpreted as supports for baskets during fruit collecting activities. (See Goodyear 1975 for additional information on the "basket-i ng" hypothesis.)

The distinction between Raab's Floodplain Village Component and Agricultural Component is not clear-cut, as Raab admits (1976: 237-238), and needs further clarification. Raab argues that the difference in vegetation and water resources between the Floodplain Component (vegetation zone 1) and the Agricultural Component (vegetation zone 3) must have had an effect on prehistoric settlement. However, a large village site and reservoir (AA:15:14) are found in what he calls the Agricultural Component. The data from Gu Achi also indicate that the distinction between these components may be arbitrary. At Gu Achi many evidences of both agriculture and domiciliary units can be found in the creosote plain that borders Gu Achi Wash. In contrast to the distribution of plant species within the Santa Rosa Wash Project boundaries, Zone 1 vegetation (as defined by Raab) is restricted to an area within just a few meters of Gu Achi Wash. The range and extent of Zone 1 and Zone 3 vegetation may also be quite variable along Santa Rosa Wash and its major tributaries.

Raab views both prehistoric and historic man-land relationships as being relatively fixed and consistent throughout all time periods. He explicitly states (1976: 238),

> Although this scenario is fabricated of sweeping generalizations, it provides a useful summary model of prehistoric settlement in the Project area, much of which is reasonably supported by fact. This model is also applicable to settlement in all known time periods. This does not mean that settlement was entirely static, but rather that settlement-subsistence shifts from one time period to another were changes in the relative states of system variables. The basic pattern of settlement and subsistence appears to have endured intact until late in the prehistory of the area. And that fact testifies to the powerful impact of subsistence on prehistoric settlement in the area.

Clearly, subsistence and settlement were circumscribed by the environmental conditions of Santa Rosa Valley. I think, however, that these "changes in the relative states of system variables" are much more significant than Raab seems to indicate (see also Goodyear 1977a: 425). For example, few dateable sites in the Mountain Component can be attributed to the pre-Classic period, a situation also reported by Goodyear (1975) for another portion of the Slate Mountains and by Stewart and Teague (1974) for the nearby Vekol Mountains. At the very least, this argues for differences in collection strategies between the pre-Classic period Hohokam and the Classic period Sells populations and perhaps major differences in the subsistence base as well. The possibility of the latter is further heightened by the fact that Sells phase populations may have practiced a seasonal bilocational residence pattern, such as discussed by Stacy (1974), while the pre-Classic Hohokam apparently did not.

Discussing the role of agriculture in his hypothesized settlement system, Raab (1976: 236) states that, "With one or two good rains, rapid-maturing strains of maize would produce a valuable supplement to wild food resources" (emphasis added). Raab, as most students before him have done, considers agricultural products secondary in importance to wild food resources. However, the intensity of agricultural activities in the floodplain of Santa Rosa Wash, coupled with comparative data from other southern Arizona sites, clearly suggests that agriculture played a major role (if not the major role) in Papaguerian subsistence (see Chapter 5 and Appendix A).

Raab's model, I believe, could have been strengthened by a discussion of comparative Hohokam data from outside the Santa Rosa Valley, such as indicated above. Although Raab likens the Santa Cruz/Sacaton phase manifestations in the Santa Rosa Valley to "riverine-type" subsistence and settlement practices in the Gila and Salt River Valleys (1976: 234), it is not clear what he means by riverine-type practices, or how these differ from whatever practices were being pursued by earlier pre-Classic period Hohokam populations in the Santa Rosa Valley.

Reassessment of the dating of ceramics from AA:5:30, AA:5:41, and AA:5:54 leads to reinterpretation of the shell and ground stone, for these data now appear to be non-comparable and drawn from a mixture of time phases as studied. For example, in the shell analysis Domeier (1976: Fig. 5) considers all plain shell bracelets from AA:5:30 to be of Snaketown/Gila Butte age even though small amounts of Santa Cruz and Sacaton phase ceramics at the site indicate a more recent occupation as well (Raab 1976: 112). All shell from AA:5:54 is considered to be Classic period in spite of the nearby

Santa Cruz/Sacaton phase reservoir. Likewise, my reanalysis of Locus 1 at AA:5:43 sheds some doubt of the Classic period dating ascribed to these materials.

Further, in the discussion of ground stone, Strawn (1976) attempts to show that more grinding activity had been practiced in the Agricultural Component sites (Raab's survey sites FN 1, 3-27) than in the Floodplain Village Component sites (Raab's AA:5:43, Loci 4 and 5) by directly comparing the ground stone assemblages from the two areas. The data from the Agricultural Component sites consist of partial surface collections from 26 temporally discrete sites of Snaketown to Sells phase age (roughly A.D. 500-1400), of which the total area is 230,958.42 sq. m (Raab 1976: Table 5-2). Data from the Floodplain Village Component are drawn from both surface and excavation collections at a partially tested reservoir (Locus 4) and a contemporaneous trash mound dating between A.D. 850-1000; the combined surface area of this collection was less than 6100 sq. m. While I agree that agriculture was most likely intensively pursued in the Agricultural Component (vegetation Zone 3), I do not think that the two assemblages are methodologically or temporally comparable in the manner attempted.

I also question Raab's argument on the significance of greater proportions of decorated ceramics in the assemblages of the hypothesized cactus camps of the Slate Mountains than in the assemblages of the flood plain village sites (1976: 212-216). Raab suggests that the high percentage of decorated ware (predominately jars) in the Slate Mountain sites is due to their function as saguaro syrup containers. To support this hypothesis, Raab (1976: 213) used ethnographic analogy, stating that according to Fontana and others (1962: 37, 47) ". . . the Papago traditionally used small, red-painted ceramic jars to store saguaro fruit sirup." Raab notes that in Classic period sites, decorated jars outnumber bowls, and both the jars and bowls tend to be small.

Raab's use of this particular analogy may be simplistic. Fontana and others (1962: 37) state that there are two kinds of saguaro syrup vessels, " a small form . . . used by an individual family . . ." and a ". . . large form . . . traditionally decorated with red paint . . . generally found stored in the village ceremonial 'big house' or 'round house'." The implication here is that the small form is undecorated, and indeed the vessel illustrated in Fontana and others (1962: Figs. 22-23) and the Papago syrup boiling vessel discussed in this monograph (Fig. 34) are both undecorated. Fontana and others (1962: 47) do state that medium-sized, small-mouthed jars were sometimes used for either water carrying or wine storage and that "It may be a safe *guess* that at one time the undecorated forms were used for water, the decorated for wine" (emphasis added). Raab does not indicate whether or not his decorated vessels from the Slate Mountain sites are small-mouthed.

The higher percentage of decorated sherds in the mountain sites as compared to the floodplain village sites may simply reflect differences in plainware vessel size. At Gu Achi, for example, several broken plainware storage jars with diameters in excess of 70 cm were present. One jar had broken into more than 500 pieces, many of which were quite large (greater than 10 cm in diameter). I suspect that such large vessels were lacking from the Slate Mountain sites and that it would be rare to find vessels with diameters greater than 50 cm outside the Floodplain Village sites. In addition, the decorated vessels at Gu Achi were "relatively" small, suggesting that there may be little size differential between the decorated vessels in Raab's floodplain villages (if comparable to those at Gu Achi) and those in the mountain sites. If these suggestions are borne out by further comparison of data, then it is obvious that plainware vessel size can greatly change the proportions of decorated wares in the two areas, especially if the total number of vessels in the mountain sites is small. The key to this whole argument is that, if at all possible, vessel comparisons should focus on proportions based on estimates of minimum numbers of vessels present, rather than solely on sherd numbers or sherd weight.

In spite of the problems pointed out in Raab's use of the Papago analogy, the hypothesis that at least some of the Slate Mountain sites are cactus fruit processing camps is still a valid one. Several of Raab's other observations regarding the use of basket rings and the location of the sites give supporting evidence to this cactus fruit processing function. It is hoped that future testing of similar sites will more clearly demonstrate this function.

Most of Raab's work is sound and insightful, and his Santa Rosa Wash study has given us important insights into the archeology of the northern Santa Rosa Valley. In fact, Raab can be credited with being the first person (since Midvale) to demonstrate the presence of a major pre-Classic period occupation in the Papagueria by Gila Basin-like Hohokam.

Hecla Mine Project

Beginning in 1972 and continuing through the fall of 1974, Albert C. Goodyear III conducted three survey and testing studies for the Arizona State University on property leased by the Hecla Mining Company in the Slate Mountains of north-central Papagueria (Goodyear and Dittert 1973; Goodyear 1975, 1977a, 1977b). This area of nearly six square miles is located principally on the south-facing slopes of the Slate Mountains (Fig. 90).

In several respects Goodyear's studies are innovative and shed light on a series of archeological manifestations largely ignored by southern Arizona archeologists. These manifestations were chiefly unpretentious, small artifact scatters and isolated artifacts. Goodyear believed that such sites relate directly to definable patterns of resource exploitation by the aboriginal inhabitants and that intensive, systematic survey of these sites and their physical settings would result in the delineation of these patterns. Much of the Hecla Mine Project area was intensively and thoroughly surveyed during the three field operations. However, the intensity of the survey and the large area circumscribed by the project boundaries necessitated the use of a sampling procedure. This was begun in the middle of the second survey and testing operation. Thereafter a 13% sample of the project area not yet surveyed was started.

Goodyear used vegetational transects and made plant counts from within the archeological sample study units ("features"). Soil and pollen samples were also collected from several of the study units. From the data generated by these studies, as well as from several ethnographic studies of historic subsistence practices, Goodyear isolated six ecological "sub-systems" where he hypothesized different resources were exploited aboriginally. These consisted of the "Bud-Flower," "Saguaro Fruit-Seed," "Prickly Pear Fruit," "Leguminous Seed," "Organ Pipe Fruit-Seed," and "Wood Procurement" subsystems (Goodyear 1975). Using ethnographic analogy and data collected during the first field study (Goodyear and Dittert 1973), Goodyear set up a series of hypotheses and test implications for the kinds of archeological manifestations that should be encountered in these subsystems. For example, he hypothesized that within the ecological subsystems most heavily dominated by saguaro, seasonal saguaro processing camps would be found. The material culture assemblages of these camps would include ramadas or brush shelters, ceramic assemblages dominated by jar forms, and grinding implements in association with ceramics (Goodyear 1975: 82). Similar criteria and reasoning were applied to the other ecological subsystems in developing a set of expectations about the nature of the archeological resources.

The data collected during the fieldwork for the Hecla Mine Project show a fairly strong correlation with the types of archeological resources predicted for the present ecological subsystems. In the Bud-Flower subsystem the major archeological features of interest were several roasting pits that may have been used to process the buds and flowers of cholla, prickly pear, or ocotillo. Likewise, four major concentrations of sherds and lithics (including ground stone) were located within the Saguaro Fruit-Seed System, closely matching expectations for hypothesized saguaro cactus processing camps. The Leguminous Seed subsystem contained a major sherd and lithic scatter with several pieces of ground stone and large numbers of shallow bowls, expected items for leguminous seed grinding camps.

Curiously, nearly all of the prehistoric sites studied by Goodyear dated to the Sells phase. There were only a few pre-Classic period manifestations. Two sites, both hypothesized saguaro cactus processing camps, contained sherds of Gila Butte Red-on-buff, the earliest ceramic type found in the survey area. Larger numbers of sherds of Santa Cruz Red-on-buff and Sacaton Red-on-buff than of earlier types were found throughout the survey area, but these types in no way match the quantities of Classic period wares. Only one major site, thought to be a large leguminous seed processing camp, dates from pre-Classic period horizons.

The scarcity of pre-Classic period remains in the bajada and mountainous areas is especially surprising when it is considered that most of the floodplain agricultural camps and village sites date to the Colonial/

Sedentary period transition. Goodyear (1977a: 425) has noted that

> Diachronically, recurrent differences in utilization patterns were found between earlier Hohokam-related groups, identified by their red-on-buff ceramics, and the late prehistoric phase, known by red-on-brown pottery [Sells phase]. The latter phase dominated nearly every procurement system. The fact that patterns of differential exploitation of these resources were observed indicates that *significant changes transpired in the wider structure of settlement-subsistence systems*. These shifts in resource emphasis documented in the mountain sector of regional subsistence require further explanations [emphasis added].

These shifts do require further explanation since work at pre-Classic period floodplain sites indicates utilization of several upper elevation economic plant species. Either the Hohokam were procuring these plants in areas different from those of the later Sells phase populations, or these pre-Classic period Hohokam were using more perishable equipment, such as baskets and wooden implements, for their procurement activities than were Sells phase groups.

Goodyear (1975: 25) noted no pre-Sells phase "Desert Hohokam" remains in the Hecla Mine study area. Nor were such remains observed in the nearby upper elevations studied by Raab (1974, 1976) or by Stewart and Teague (1974). Goodyear also observed that Haury had made no firm identification of the "Desert Hohokam" pottery types, Vamori Red-on-brown and Topawa Red-on-brown at Ventana Cave (see Haury and others 1950: 347-348). A personal examination of the Ventana Cave collection revealed a few sherds possibly matching Withers's (1973: 24-33) descriptions of these pre-Classic "Desert Hohokam" pottery types, but they appear to be local variants of the Tucson Basin pottery types, Rillito/Rincon Red-on-brown and Cortaro Red-on-brown. Once again, these data question the validity of the "Desert Branch Hohokam" concept.

Goodyear also noted a total lack of the Classic period pottery type, Sells Red, in the Hecla Mine Project sites. The absence of Sells Red in upper elevation Classic period sites has also been observed by Raab (1974) in his study area and by Stacy (1975: 185) in several other portions of the Papagueria. The meaning of this difference, functional or temporal, is not known.

A significant contribution of the Hecla Mine Project was the isolation of several sites possibly dating to the protohistoric period (Goodyear 1977b), the transition between the latest known prehistoric sites in southern Arizona (about A.D. 1450) and the time of the initial Spanish colonial missionary work in Northern Sonora and southern Arizona (about A.D. 1700). The distinctive feature of these sites was the presence of a thin, brown plainware pottery type. Initially, this pottery was believed to have been a product of Yuman-related occupation of the area (Goodyear 1975: 48). However, further analysis and discussions with experts in Yuman ceramic classification excluded the possibility of Yuman origin (Goodyear 1977b). Goodyear noted that a thin, brown plainware pottery had also been recovered in the uppermost levels of Ventana Cave and from a few sites in Raab's Santa Rosa Wash survey. He then hypothesized that this pottery type represented "the archaeological by-products of indigenous protohistoric Papago groups making seasonal usage of wild plant resources native to the paloverde-saguaro communities" (1977a: 212).

Goodyear found the thin, brown plainware pottery in several sherd and lithic scatters in the Prickly Pear Fruit subsystem. Dominance of jar forms, lack of ground stone, and the location of the sites led Goodyear to conclude that these protohistoric sites were connected with prickly pear utilization. Specimens of the thin, brown plainware pottery were also associated with a possible saguaro processing camp that contains a burned structure radiocarbon dated at A.D. 1370 ± 100. Goodyear suggested that the Papago village of Kohatk may have been the center from which these plant processing sites were established. He also noted that the apparent patterns of subsistence during the protohistoric period seem to differ greatly from earlier Sells phase occupations.

This author has not had the opportunity to examine the protohistoric collection from the Hecla Mine Project. However, personal examination of the Ventana Cave ceramics suggests that the thin, brown plainware in the large horizons may have an affinity to Whetstone Plain (see DiPeso 1956: 1.c 154-155), a Sobaipuri plainware known from the San Pedro and Santa Cruz Valleys (Masse 1979, in press c; Doyel 1977b). If the Hecla Mine Project specimens are indeed similar to those from Ventana Cave, as Goodyear suggests, then their designation as early (protohistoric) Piman does appear to be valid. This argues for a fairly widespread, early Piman cultural tradition in southern Arizona, which agrees with Spanish documentation of the distribution of Piman speakers around A.D. 1700 (see Pfefferkorn 1949: 27-30; Bolton 1936: 246-248). The date of A.D. 1570 ± 100 for the burned structure would be by far the earliest documented Piman manifestation in southern Arizona if the ceramic associations are valid. Exciting possibilities are suggested by such an early date, but more extensive validating evidence should be gathered before the date is accepted unconditionally.

A few additional problems and questions of interpretation of Goodyear's data also arise. First, Goodyear presents what appears to be a strong argument for the long term stability of his proposed environmental subsystems (1975: 19-21). However, his study dealt with less than 200 vertical meters of elevation (about 1600-2200 feet above mean sea level). Small shifts in the vertical distributions of certain plants over the past 1000 years may have been more likely than Goodyear indicates. An even greater possibility exists that extended periods of drought or increased precipitation may have significantly affected the abundance of certain types of cacti, such as prickly pear, both within the zone as a whole and within portions of that zone (Thomas R. Van Devender 1979: personal communication). A vertical shift of 25-50 m in the maximum densities of certain plant species within these zones or periodic changes in abundance could conceivably alter the cultural and behavioral interpretations drawn from the present distribution of sites.

Another possible problem arises from the assumption that site function should relate to the environmental zone or subsystem in which a site is found. For example, in his discussion of "saguaro camps" located in the Saguaro Fruit-Seed subsystem, Goodyear (1975: 82-118) attempts to show that all archeological manifestations at these sites relate directly to saguaro gathering and processing activities. While it is certainly possible that saguaro-related activities were a major part of site function, other types of subsistence activities may have been taking place in the same site at the same time or at different times of the year. There is no reason why these "saguaro camps" could not have been used as bases from which to gather yucca (Yucca elata), agave (Agave deserti), or jojoba (Simmondsia chinensis), specimens of which were found in the upper deposits of Ventana Cave (Haury and others 1950: 167-169).

Goodyear (1975: 249), like Haury (Haury and others 1950), Raab (1974), and most other Papaguerian scholars, views agriculture as playing, at best, a supporting role to that of hunting and gathering. However, agriculture appears to have been more important to the pre-Classic period Hohokam populations in the Papagueria, especially those of the late Colonial and early Sedentary periods, than has been previously thought.

Finally it seems that Goodyear too hastily accepts Raab's (1974, [illegible]) view of the nature of the pre-Classic period Hohokam occupation (Goodyear 1975: 119).

> Raab (1974) has suggested that while the Hohokam sites in the floodplain are much more numerous than the [illegible] phase sites, they may represent a much briefer occupation period. The majority of Hohokam sites date to the transition from Santa Cruz to Sacaton, suggesting a brief period of settlement, perhaps no more than 50 years. Raab (1974) has produced two radiocarbon dates from these mixed Santa Cruz-Sacaton sites which date near the hypothesized boundary. Only a few of the floodplain sites date to pre-Santa Cruz times, further indicating that Hohokam occupations in the region were relative', brief and unsuccessful. If this sequence of events is correct--a general pattern which is obvious from the mountain sites of the Slates (Goodyear and Dittert 1973; Raab 1974), from the Vekols (Stewart and Teague 1974) and from Ventana Cave (Haury 1950)--the Hohokam groups would not be expected to have left many of their diagnostic remains in the mountain camps.

While the efflorescence of Hohokam culture in the transition between the Santa Cruz and Sacaton phases may have been of short duration, perhaps as little as 50 years, Hohokam occupation of the Papagueria should not be considered brief and unsuccessful. The Hohokam appear to have occupied much of the Papagueria continuously for nearly 600 years (about A.D. 500-1100). The abandonment of the Papagueria between A.D. 1000-1100 was part of a [illegible] spread phenomenon occurring throughout much of southern Arizona (see [illegible] in press a); the Hohokam seem to have successfully adapted to the conditions in the Papagueria until that time. The lack of pre-Classic remains in upper elevation areas should not be construed as representing a brief occupation of the Papagueria by the Hohokam. Rather, we must seek other explanations for the difference between the patterns of pre-Classic and Classic period utilization of these upper elevation areas.

While restricted in terms of synthetic regional cultural problems, the Vekol Mine Project study by Goodyear is an exemplary model of the use of environmental data and ethnographic analogy in a hypothetico-deductive framework. It is both sound and innovative, especially concerning the relationship between archeological deposits previously believed to be insignificant and the physical setting in which they are found. One of the most important contributions of Goodyear's study in terms of the present work is the recognition of possible major changes in subsistence strategies between the pre-Classic Hohokam and the Classic period Sells phase populations and between the Sells phase and the early historic period.

Vaiva Vo-Kohatk Road Project

In 1976 and 1977 a survey and subsequent testing program were undertaken by the Arizona State University along the route of a proposed road in the northern Santa Rosa Valley. This 16-mile long, 100-foot wide roadway lies on the western flood plain of Santa Rosa Wash, adjacent to and north of the Santa Rosa Wash Project and the Vekol Mine Project boundaries.

The survey of the road right-of-way and associated construction features discovered 18 archeological sites and several isolated artifacts (Brown 1976; Yablon 1977). These sites included petroglyphs, an unusual masonry structure of undetermined age, 17 prehistoric sherd and lithic scatters, and a village that extended in time from the Snaketown to the Sacaton phase. Three of the sherd and lithic scatters were dated to the transition between the Santa Cruz and Sacaton phases, one to the Sells phase, another to a Classic period occupation by a Yuman-related population; the other 12 were of undetermined prehistoric age. In general, these sites closely resemble those found by Raab (1976) in his "Agricultural Component."

In the early spring of 1977, Yablon (1978) investigated six of the sherd and lithic scatters. Only one site was comprehensively excavated while the other five were surface collected and minimally tested. Nonetheless, several significant observations were made; five of the sites appeared to be pre-Classic Hohokam while the sixth exhibited a large assemblage of Classic period Yuman ceramics. The site most intensively investigated, a pre-Classic period Hohokam site designated AA:5:14 (ASU) [illegible] subjected to an initial testing program using two 2 x 2 m test pits [illegible] series of post holes 10 cm in diameter and 30 cm deep. The results of this program were inconclusive and uninformative (Yablon 1978: [illegible]).

Yablon then had the top 15-20 cm of overburden cleared from AA:5:14 with a road grader and in the process exposed several features, including a compacted occupation surface, hearths, and several post holes. Although Yablon refers to the compacted occupation surface as "house floor" (1978: 154), the evidence is tenuous. The "house floor" is amorphous; dimensions are not given, the hearth associated with this floor is not plastered (as typical of hearths in most houses), and the associated post holes do not appear to form a pattern typical for houses (Yablon 1978: Fig. [illegible]). Ethnographically, both ramadas and outdoor kitchens have been reported to contain windbreaks (Russell 1908: 153-157) that could produce a post hole pattern like that at AA:5:14 (ASU). While this feature may or may not represent a house, it is an occupation surface and indicates some degree of extended site usage. The hearth associated with the occupation surface yielded a radiocarbon date of A.D. 680 ± 55. Yablon accepts this dating (Gila Butte/Santa Cruz phase transition) as an accurate reflection of site occupation; however, the rest of the material culture assemblage from the site suggests a slightly more recent pre-Classic period date.

The other five sites contained several hearths and occasional [illegible] concentrations. One hearth was radiocarbon dated at A.D. [illegible] ± [illegible], one of the earliest radiometric dates from a Hohokam-related site in the [illegible]ria. Unfortunately, the associated material culture assemblage is [illegible] and it difficult to judge the validity of this date. Another site, AA:[illegible] (ASU), contains a predominance of Yuman ceramics ("Lower Colorado Buff Ware") and a large assemblage of chipped stone tools. Yablon suggests that AA:[illegible] (ASU) may be a Classic period hunting and gathering site rather than a locus of agricultural activity. However, the large ceramic assemblage, the presence of some ground stone, and several lithic and ceramic specimens diagnostic of occupation from the Sedentary period through early historic times suggest that the site represents the accretion of several temporally distinct occupations not limited to hunting and gathering activities.

Yablon satisfactorily demonstrated the agricultural nature of the five pre-Classic period Hohokam sites. The presence of macrobotanical specimens of corn at several of the sites, ground stone assemblages characterized by trough metates and shaped, rectangular manos, and the location of these sites in the creosote-dominated floodplain all indicate agricultural pursuits. Yablon attempted to integrate the information obtained from these sites into a holistic picture of settlement system dynamics in the Santa Rosa Valley; possibly because of inadequate sampling of most sites and possibly because of biases in his model, a holistic view is not achieved.

Yablon uses the historic Papago bilocational residence pattern as the analog for interpreting the prehistoric settlement system (1978: 7, 15-16). As previously mentioned, there has been no documentation of pre-Classic winter well villages in the Papaguería, a point that Yablon notes (1978: 155). In addition to accepting the Papago bilocational residence model, Yablon seems to accept the subsistence ratios suggested by Castetter and Bell (1942: 56-57) for the Pima and Papago as applicable to the pre-Classic Papaguerian Hohokam. Thus, he implies that 20 percent or less of the prehistoric subsistence base was satisfied by agriculture. Evidence previously discussed in this volume indicates greater dependence on agriculture (see also Gasser, Appendix A).

Seasonal usage of the Vaiva Vo-Kohatk Road sites does not seem adequately demonstrated. There is no question that the sites were occupied during the summer months since they contain macrobotanical specimens of corn, mesquite beans and pods, and saguaro seeds. On the other hand, the absence of winter plant indicators is common at many large permanent sites, such as Snaketown in the Gila River Valley; their absence at small sites, such as those tested by Yablon, should not be construed as evidence that the sites were not occupied in the winter (see Appendix A). In accepting the Papago bilocational residence model Yablon does not address Raab's suggestion (1974: 235) that the western floodplain of Santa Rosa Wash was permanently, as well as seasonally, occupied by the Hohokam during the late Colonial and Sedentary periods.

A substantial trash mound at one of the sites not investigated by Yablon and the large size of several of the sites that were only [illegible] tested seem to imply permanent occupation. If such were the case, then domestic water supplies would of necessity have been obtained from either nearby washes or the distant Santa Rosa Wash. I tend to agree with [illegible] that most floodplain sites removed by distances of more than one mile [illegible] major washes probably do represent seasonal agricultural camps. However, at least a few of these sites, such as Raab's (1976: AA:5:[illegible], [illegible]) AA:5:54, were most likely occupied year round.

Several questions are raised by the treatment of plainware [illegible]. For example, the category "Gila Plain" includes plainware sherds tempered by either sand or by micaceous schist. Yablon states (1977: [illegible]) [illegible] type that

> The most abundant tempering material appears to be angular quartz sand. Mica particles are frequently, but not always, present. . . . Taken individually, these sherds demonstrate considerable variability among themselves. However, taken as a group, they closely conform to the overall type description established by Haury (Gladwin and others 1937: [illegible]; Haury 1976: 223).

Upon reviewing the source material by Haury (Gladwin and others [illegible] 205-261; Haury 1976: 223) and the original type description by the Gladwins (1933: 26), it is clear that, by definition, Gila Plain must contain [illegible]. A quote from Haury (1976: 223) illustrates this point.

> While some variation in temper is observable, most likely the result of individual choices, the normal tempering material was crushed mica schist, liberally mixed with clay. Both angular and rounded quartz grains are also often present. Mica platelets and temper particles cover the surface, sometimes amounting up to 30 to 40% of the surface area [emphasis added].

The existence of a mica-free variant of Gila Plain appears to be substantiated by several studies (see Raab 1974: 315; Goodyear 1975: [illegible]; [illegible] in press c). However, this variant may be temporally, and perhaps [illegible], culturally, distinct from micaceous Gila Plain. Lumping the plainware categories obscures some potentially useful data, especially because [illegible] temporally diagnostic specimens are lacking at these sites. The following quote from Goodyear (1975: 27) emphasizes the shortcomings of this treatment of plainware ceramics.

> More intensive studies of Papaguerian plainwares and their respective functional and technological attributes should be undertaken. It is a noteworthy fact that tempering variability of a widespread nature and of obvious chronological significance has been noted by our studies, as well as all previous and concurrent investigations. The fact that this variability has been handled by no less than three classificatory systems, however, is cause for concern. While a preoccupation with ceramics at the expense of other behaviorally significant material culture has been rightfully criticized in southwestern archeology, it is obvious that there is great need for further clarification of plainware variability in the Papagueria. I would submit that there will be no sensitive diachronic understanding of upper elevation prehistoric sites in this region until such studies are made. Eroded plainwares are the most common ceramic class available from these open sites and in most cases the only means by which to make cultural and chronological evaluations.

The problems discussed above are mainly interpretive in nature. By and large, Yablon's work demonstrates the importance of the sherd and lithic scatters that abound near the major washes for our understanding of Papaguerian archeology. Yablon (1978: 38) cogently points to the description of Papago settlements by Joseph, Spicer, and Chesky (1949: 60) and notes the similarity between this dispersed pattern and the pattern of prehistoric sherd and lithic scatters on the Santa Rosa Wash flood plain.

> Archaeologically, it would not be surprising to find this pattern represented by large numbers of discontinuous artifact scatters, punctuated by occasional house floors and other features. Relating the various discrete loci both spatially and temporally would present a major problem (Yablon 1978: 38).

One of the most difficult tasks confronting us and limiting the interpretation of settlement systems in the Santa Rosa Valley is the problem of ascertaining the spatial and temporal relationship of the many discrete loci. This is certainly a critical problem at Gu Achi, where 44 spatially distinct loci were located.

Miscellaneous Projects--Northern Santa Rosa Valley

Several other projects have been conducted in the northern Santa Rosa Valley, but these have been limited in nature, with results that complement the three major studies previously described. Perhaps the most significant was the Vekol Mine Project (Stewart and Teague 1974). This study, a survey of an eight-square-mile portion of the eastern slopes of the Vekol Mountains (see Fig. 90) was done by Prescott College in 1971. Stewart and Teague (1974: 3-6) used the somewhat incomplete field notes from this survey and combined them with an environmental reconnaissance performed in 1973 in order to write their report.

The intensity and system of the survey were not explicitly reported, but it appears likely that the survey was not as intensive as that performed by Goodyear (1975) in the Slate Mountains. A review of the distribution of sites located within the Vekol Mine Project (Stewart and Teague 1974: Fig. 2) boundaries suggests to this author that the area was not systematically surveyed because several large areas are shown to be free from sites. The information obtained by Goodyear from the nearby Slate Mountains indicates this is unlikely.

In general the prehistoric sites in the Vekol Mine Project study resemble those recorded by Goodyear (1975) and Raab (1974, 1976) in the Slate Mountains. Stewart and Teague (1974) divided these sites into five categories--gathering sites, base camps, trails, whole vessel (pot break), and anomalous sites. The first two categories are sherd and lithic scatters that are distinguished from one another by extent and density of artifacts, base camps having a substantially larger quantity of artifacts. All three possible base camps recorded are pre-Classic period Hohokam. Two of these appear to date to the Snaketown phase (AZ Z:8:53 and 54, which are most likely a single site, and AZ Z:8:61), while the third dates from an unknown time in the pre-Classic period (AZ Z:8:58). In contrast, in the Hecla Mine Project all the large sites, except the single "Papaguerian seed processing camp" (Goodyear 1975), date from the Classic period. However, the original survey by Prescott College did not quantify the sherds of any ceramic type present, and the bulk of the material at these sites could conceivably date from more recent times.

Classic period manifestations in the Vekol Project area consist of one small village with a single trash mound and three sherd and lithic scatters in close proximity to one another. As the pre-Classic and Classic period remains seem to occur in roughly the same numbers, it is difficult to estimate the date of the numerous temporally undiagnostic lithic and plainware sherd scatters and, thus, to estimate the date of heaviest use of the area.

Plainware ceramics were classified into two categories, Gila Plain and "Gila Plain, Kohatk Variety." The latter type is apparently a coarse, micaless variant of Gila Plain, named by Donald D. Wood, but not described in the literature (Yvonne G. Stewart 1978: personal communication). It is probable that this variant is similar if not identical to the "Gila Plain, Salt Variety" discussed by Raab (1974: 316-317) and perhaps even the "Gila Plain, Gila Bend Variety" reported by Wasley and Johnson (1965). The Kohatk variant of Gila Plain appears to be much more common than micaceous Gila Plain, but the cultural and temporal meaning of this relationship is uncertain. Surprisingly, no sherds of Wingfield Plain, the dominant pottery type noted by Raab (1974), Yablon (1978), and Goodyear (Goodyear and Dittert 1973), were reported from the Vekol Mine Project. It seems probable that sherds of "Wingfield Plain" were classified with the Kohatk variant of Gila Plain.

Two other small archeological projects have been completed in the northern Santa Rosa Valley. The first was a survey by Arizona State University of two construction sites adjacent to the Hecla Mine Project area (Bruder 1975). Within this area, approximately one square mile, Bruder found numerous isolated artifacts and several small lithic and sherd and lithic scatters similar to those reported by Goodyear (1975). Most of the temporally diagnostic remains were of the Sells phase.

The other small project was the Arizona State Museum's survey of a proposed line corridor that traverses the Papagueria en route from Tucson to the Salt River just west of Phoenix (McDonald and others 1974). This southeast-northwest line bisects the Santa Rosa Valley a few miles north of the Santa Rosa Wash Project boundaries. Three sites were recorded next to Santa Rosa Wash--a small Classic period village with a single trash mound, a larger Colonial period Hohokam village with two trash mounds, and a large sherd scatter of Colonial period age. The archeological remains at these sites and the site locations correspond well with the remains studied by Raab in the Santa Rosa Wash Project.

The transmission line survey also recorded a series of sites along Aguirre Wash, a major wash in the eastern Papagueria. All the datable sites (five of which are villages) in the floodplain of the Aguirre Wash date from the Classic period. The absence of pre-Classic period sites suggests a settlement pattern different from the Santa Rosa Wash area where pre-Classic sites dominate the floodplain. However, the limitations of a narrow-corridor right-of-way survey may have artificially created this difference. A lithic site was found near several of the villages and was subsequently tested (Spain 1975). This proved to be a quarry and tool manufacturing site, but lack of diagnostic specimens prevented its temporal placement.

A final northern Santa Rosa Valley project discussed here is not of actual field study but rather an archaeological overview of southwest Pinal County prepared for the Army Corps of Engineers (Ackerly and Rieger 1976). The purpose of this overview was to assess the impact on archaeological resources of a proposed diversion system that would divert water from distant washes to the Tat Momolikot Dam and Reservoir.

Ackerly and Rieger (1976) drew on the environmental and archaeological data from Raab's (1974, 1976) and Goodyear's (1975) studies in an attempt to develop a predictive model for locating certain types of archaeological sites. For this purpose they utilized aerial photographs in order to extend the known patterns of site location and vegetation zones described by Raab and Goodyear in the unstudied portions of the proposed project boundaries. In addition, they presented an interesting comparative study of major physiographic variables of four north-south trending drainage basins: Santa Rosa Valley, Imperial Valley, Aguirre Valley, and the Santa Cruz River. The study variables included size of basins, basin relief, basin shape, slope gradient, amount of alluvial soil, and combinations of these variables. This information was extracted from U.S.G.S. topographic maps. Ackerly and Rieger (1976: 3745) were able to make several interesting observations regarding physiographic variables and their implications for site location. First, the western side of the drainage basins tends to have a large number of small drainages joining together to produce a greater concentration of outwash fans than is true for the eastern side. Such distribution implies that villages dependent on floodwater farming may occur more frequently on the western side.

Slope gradient studies indicate that the eastern side of all the drainages except the Aguirre Valley are much steeper than the western side. This suggests that the eastern valley flanks will have a larger number of microenvironments more closely spaced (because of the vertical zonation of many plant species) whereas the microenvironments of the western flanks will be more widely spaced on the more gentle slope. Ackerly and Rieger hypothesized that wild plant gathering and processing camps should be more prevalent in sections of the eastern valley flanks where eastern slopes are significantly steeper than western slopes. There seems to be some support for this hypothesis in the Santa Rosa Valley; the Hecla Mine Project area (Goodyear 1975), which lies on the eastern side of the valley, appears to have a significantly greater number of cultural resources than does the Vekol Mine Project area (Stewart and Teague 1974), which lies on the western side of the valley. However, as mentioned earlier, differences in survey methodology could have created this situation.

Ackerly and Rieger noted that while the percentage of small drainages per standardized area in the Santa Rosa Valley is comparable to that of the Santa Cruz Valley, the Santa Cruz Valley contains a much greater percentage of alluvial soils (1976: 41-42). They then hypothesized that the Santa Cruz Valley contains larger, more complex, and more numerous agricultural villages than the Santa Rosa Valley because of the larger percentage of alluvial floodplain soils. This model may be simplistic, in that the types of agricultural practices (and concomitant climatic variables) possible in each region are more directly involved in this difference than is soil type (though the two are certainly related). Dry farming was extensively practiced in the Santa Cruz Valley (see Masse in press b) while farming in the Santa Rosa Valley and most other portions of the Papagueria most likely used floodwater techniques. Had the climatic situation of the Papagueria been more conducive to dry farming, quantitative cultural differences between the Santa Rosa and Santa Cruz Valleys would have been substantially reduced. Further, recent surveys in the Santa Rosa Valley suggest that quantitative cultural differences between the Santa Cruz and Santa Rosa Valleys may not be as great as Ackerly and Rieger suggest.

Since the relationship between cultural and environmental variation in Raab's and Goodyear's studies is questioned by this author, Ackerly and Reiger's attempt to apply this data uniformly to the entire study area is also questioned. Ackerly and Rieger used this data to develop a series of vegetational zones (modeled after those of Raab 1976) that were then plotted on topographic maps with the aid of aerial photographs (Ackerly and Rieger 1976: Figures 5-13). Definition of the vegetational zones and the cultural implications applied to the zones, however, require clarification. For example, the entire area surrounding the site of Gu Achi and extending south to the upper reaches of the Santa Rosa Wash was designated as vegetational "Zone 2b" (Ackerly and Rieger 1976: Fig. 10). Ackerly and Rieger state that Zone 2b (1976: 47)

> consists of a lower bajada vegetation complex consisting of ironwood, paloverde, mesquite, saguaro, hedgehog cacti, chain cholla, pencil cholla, and acacia. . . . Expected prehistoric activity loci in this zone include (1) leguminous seed extraction loci, (2) wood procurement loci, (3) plant extraction loci, and (4) possibly, hunting loci.

While these cultural activities may indeed be associated with a lower bajada vegetation complex, there are many square miles within this area designated Zone 2b by Ackerly and Rieger that are actually creosote-dominated plains containing large villages and agricultural camps.

Ackerly and Rieger divide the Agricultural Component (Vegetation Zone 3) into two parts. Their definitions of these are excerpted below (1976: 47-48).

> Zone 3a consists of a riparian vegetation complex similar in composition to that described for Zone 1, but more limited in extent since it is associated with intermittent tributaries feeding into the main stem of major washes. Mesquite is the dominant species with ironwood the subdominant species. Both species tend to occur at a density considerably lower than that of main stem vegetation complexes. Expected activity loci for this zone include (1) hunting loci, (2) wood procurement loci, (3) plant procurement loci, and (4) possibly

> smaller base camp (i.e. village) sites. These loci will generally be less numerous than activity loci associated with other zones in the region and will be of more limited extent.
>
> Zone 3b: Consists of an even lower density of mesquite and ironwood than that associated with Zone 3a. This zone is usually found situated between tributary washes feeding into the main stem of major washes. Remains are on the whole less dense here than for any zone in the study region, but these zones are of limited extent and highly discontinuous in their distribution.

When site locations in the Santa Rosa Wash Project area (Raab 1976: Fig. 4) are compared with the vegetation zone map by Ackerly and Rieger (1976: Fig. 7), discrepancies between the field data and their model appear. One of the largest and most complex sites (AZ AA:5:54) lies squarely in Zone 3b--as would the sites studied by Yablon (1978: Fig. 2) while many large sites are situated in Zones 3a and 2a.

Ackerly and Rieger are probably correct in assuming that site density in Zone 3b will commonly be less than that in either Zone 1 (the floodplain adjacent to major washes) or Zone 3a; however, the sites in Zone 3b are not necessarily less complex and certainly not less expensive to mitigate than those of the surrounding zones. There is a real danger in using untested predictive models of site location as a management planning tool, a point that Ackerly and Rieger explicitly recognize (1976: 60). The model presented by Ackerly and Rieger is insightful and provides a useful base from which to build future models for predicting site location in the Papagueria. It is clear, however, that site location, at least in the valley floors, may be more complex than was once suspected, and there are likely to be environmental and cultural variables that have not as yet been accounted for in settlement distribution.

Another overview that deals with the northern Santa Rosa Valley and the Sells area has recently been prepared by Coe (1979). Coe thoroughly examines the previous literature and provides a useful critique of methodological and interpretive problems. Coe, however, accepts the Desert Branch vs. River Branch Hohokam dichotomy. Her overview is well conceived and provides an important perspective, though differing from the perspective of this report.

Western Archeological Center Survey and Testing Program

Since 1973 the Western Archeological Center of the National Park Service has provided a cultural resource management program for the Bureau of Indian Affairs, Phoenix Area Office, Branch of Roads. Survey and testing projects on the Papago Indian Reservation are often handled in-house by National Park Service crews. From 1973 to 1975 this program also served as an archeological training program for crews of Papago Indians who participated in both survey and testing activities.

The Western Archeological Center program on the Papago Indian Reservation has resulted thus far in three publications (Stacy 1975; Rosenthal 1977a; Rosenthal and others 1978); but other survey and testing data remain both unanalyzed and unreported. In this discussion the work that has been reported on will be reviewed and the findings of the testing accomplished at Pisinimo and Sil Nakya, two Colonial/Sedentary period sites, will be introduced. The collections from these two sites have not been studied exhaustively, but enough information has been gathered to relate these sites to other known contemporaneous Hohokam sites in the Papagueria.

The work accomplished in 1975, including the data from Pisinimo and Sil Nakya, is presented first. This is followed by a discussion of the Quijotoa Valley Project. The section concludes with a review of various small projects undertaken by the Western Archeological Center from 1975 through 1977.

1973 Survey and Excavation Program

Much of the 1973 survey work was supervised by V.K. Pheriba Stacy (1973, 1975). She surveyed 72.6 miles of 200-foot-wide road right-of-way. This was comprised of five locations in different parts of the reservation and spanned an area 60 miles east-west and 33 miles north-south (1975: Fig. 1); all locations were confined to the flood plains of major washes. Stacy encountered 25 significant sites and recorded numerous isolated sherds, lithics, and small artifact scatters or isolated features (such as rock rings and hearths) that were not given site status. Most sites and isolated features were dated to the Sells phase, with no evidence of occupation dating before the Santa Cruz phase. The general nature and distribution of these culture remains appear to be similar to those in the northern Santa Rosa Valley.

The necessity of confining the survey to the road rights-of-way has distorted Stacy's observations and conclusions. Stacy concluded that the small number of sites located in her survey indicated that the flood plain may not have been considered suitable for settlement by the prehistoric inhabitants (1975: 183). The work of Rash (1976) and Yablon (1978) has demonstrated that this is not the case. The skewing effect of a right-of-way survey can be seen most clearly at Gu Achi, where Stacy recorded only 10 loci. Thirty-four loci were not discovered, including the 10 largest. Thus, since the road right-of-way at Gu Achi cut through almost solely the pure transitional Santa Cruz/Sacaton phase components, Stacy was unaware of the immense area of late Pioneer and early Colonial period material that lay only a few hundred meters away. Nearly all of the other sites recorded by Stacy's survey were Sells phase age, in contrast to the findings of Rash (1976) and Yablon (1978) for floodplain sites where the majority of sites dated from the transition between the Santa Cruz and Sacaton phases. Further, all sites located in Stacy's survey had a single component and lacked vertical stratigraphy. No doubt this is correct for many of the sites, but, as exemplified by Gu Achi, some sites are much more complex.

Stacy (1975: 185) noted a lack of Sells Red pottery in the Classic period floodplain sites, a fact paralleled in the Santa Rosa Wash Project area. She also noted the presence of Sells Red in Classic period foothills sites and suggested that the differential distribution of this pottery type may be related to site function. However, I suspect that temporal factors may also be important in the distribution of Sells Red.

Stacy tested several sites with either small, hand-excavated test pits or road grader cuts. Of all this testing, only two sites, one of them Gu Achi, yielded any significant subsurface features. The other sites, at least in the portions tested, were apparently only surface deposits. Even at Gu Achi, hand-excavated test pits failed to reveal subsurface remains, and it was only the road grader cut that exposed a large number of hearths and other subsurface features. The failure of small, hand-excavated tests to produce significant information is a pattern remarkably similar to that noted by Yabion (1979) and Raab (1974, 1976).

In the late fall of 1973, the Western Archeological Center conducted a survey near Sells Wash, extending west from the modern Papago village of Sells toward the village of Gu Gidai (notes on file at the Western Archeological Center). This survey encountered ten major sherd and lithic scatters, six of which were subsequently tested with hand-excavated test pits. These tests were largely inconclusive, and few artifacts and no subsurface features were encountered. Material from the survey and testing program has not yet been analyzed, and the sites have not been temporally defined more precisely than simply to denote them as prehistoric. All but one of the sites contained ground stone (usually [illegible]), and some of the sites had associated hearths. At the very least these sites are probably agricultural camps, and perhaps some are even villages. [illegible] usually absent from these sites, which suggests a Classic period occupation because pre-Classic sites usually have ample amounts of shell. However, the collections should be analyzed before accepting this interpretation as valid.

Pisinimo

Pisinimo, a site recorded during Stacy's survey in the [illegible] Valley (Fig. 90), was tested for two weeks in 1975. As previously mentioned, the testing was conducted concurrently with the latter stages of the excavations at Gu Achi. The author has somewhat cursorily examined the collections from this testing program; this analysis, combined with reports on archeological fauna by Johnson (1977) and on shell by Ferg (1977), provides the basis for the following discussion.

The site of Pisinimo is located slightly more than a half mile [illegible] of the modern Papago village of Pisinimo and about 2.5 miles east of the main channel of San Simon Wash (Fig. 90). The site is in a flat upper floodplain-lower bajada environment dominated by creosote, a physical situation not unlike that of some of Raab's and Yabion's sites in the western floodplain of Santa Rosa Wash. Several small southwest-trending washes pass the site.

The site of Pisinimo is a sherd and lithic scatter covering an area of about 11,000 sq. m. Two temporal components were isolated. One is a small historic Papago trash scatter, and the other is a prehistoric artifact scatter. The historic trash scatter consisted of plainware ceramics in association with one broken white earthenware vessel. Several plainware body sherds had the "rim coil" treatment characteristic of historic ceramics (see Haury and others 1950: 344-345). The rim coils, sand-temper, thinness of some specimens, and a lack of organic temper indicate an affinity with material recovered from Batki (personal inspection of the Batki collection at the Arizona State Museum, Tucson) and can be interpreted as belonging to the Period I Ceramic Complex (Fontana and others 1962: 103-104). However, the presence of the white earthenware bowl, which probably dates between A.D. 1850-1920 (George A. Teague 1978: personal communication), suggests a late 19th century date. While Fontana and others (1962: 109) suggest that thin, brown-colored plainware pottery disappears after A.D. 1860, the meager evidence from Pisinimo possibly suggests a longer continuance. As Goodyear (1977b) has pointed out, this pottery type may eventually play a major role in our understanding of protohistoric and historic culture history in the Papagueria.

The prehistoric component was a sparse (1 to 16 artifacts per sq. m) artifact scatter throughout most of the site area, with two sizeable concentrations. Fourteen five-foot-square areas were tested in various locations throughout the site. Artifacts were located as deep as 21 inches below the ground surface, but generally the cultural deposits were shallow, not exceeding 12 inches. No features were recorded either on the surface or during the subsurface testing, other than a cache of shells. However, charcoal and ash in several of the excavation units suggest the presence of nearby hearths.

The prehistoric cultural assemblage compares and contrasts interestingly with the Santa Rosa Valley site assemblages, including Gu Achi's. Immediately noticeable is the small percentage of decorated sherds, in comparison to plainwares. It is estimated that no more than 2% of the sherds from Pisinimo are decorated, which contrasts with the from contemporaneous deposits at Gu Achi but is similar to the floodplain sites excavated by [illegible] and also to Valshni Village (Withers 1973: 49). A quick sorting of Pisinimo ceramics discovered only 23 painted sherds, 22 of which were buffwares; the remaining sherd was a redware. Five of the buffware sherds were transitional Santa Cruz/Sacaton Red-on-buff, one was Gila Butte Red-on-buff, while the remainder were either unidentified as to specific type in the pre-Classic period (9) or were undecorated (7). At least eight different buffware vessels were represented, bowls and jars equally. One of the bowl sherds, made from buffware clay, contained several large quartz sand particles in the crushed micaceous schist temper and was highly polished on both the interior and exterior. This sherd possibly represents a locally made product. The other buffwares are macroscopically indistinguishable from Gila Basin specimens. The single redware sherd was a thin bowl sherd, heavily tempered with mica, with an interior and exterior slip, that bears a close resemblance to Vahki Red of the Pioneer period and thus appears somewhat out of place temporally with respect to the rest of the ceramic assemblage. A surprising situation, considering the southern location of Pisinimo in the Papago Reservation, was the lack of Trincheras culture sherds and Vamori Red-on-brown sherds. Clearly, the ceramic assemblage at Pisinimo reflects ties with northern (Gila Basin Hohokam) rather than with southern populations (Trincheras culture).

The plainware assemblage is similar to that of Gu Achi. The assemblage is dominated by schist-tempered sherds though the schist is more finely crushed and seems to form a smaller percentage of the total sherd volume than is true at Gu Achi. This may suggest that schist sources were farther from Pisinimo than from Gu Achi. Sizeable numbers of sherds tempered with crushed altered andesite(?) are present along with smaller numbers of sherds tempered with altered andesitic(?) grus. Gila Plain forms approximately five percent of the plainware assemblage. Sand-tempered specimens are not as frequent at Pisinimo as at Gu Achi, but the difference is made up by larger numbers of schist-with-sand-tempered wares. Jar forms greatly outnumber bowls for all plainware pottery types. Few specimens approach the large size of the jars found in Excavation Area 1 at Gu Achi.

Chipped stone forms only a small percentage of the entire artifact assemblage, similar to the situation at Gu Achi. Most specimens are [illegible] secondary decortication flakes, some with utilized margins or unifacial retouch. A few cores are also present. The primary chipped stone material type is a reddish-brown rhyolite. Somewhat smaller numbers of a coarse-grained green rhyolite are also found. Three or four pieces of green quartzite, similar to that material at Gu Achi, were noted.

While no pieces of metate were recovered, several manos and handstone fragments were found at Pisinimo. These all appear to be ovoid to round in shape and include both unifacial and bifacial examples. However, the fragmentary nature of some specimens makes accurate identification difficult. Noticeably lacking are the subrectangular well-shaped manos that are the normal complement of trough metates. The material type was predominately quartzite, but specimens of vesicular basalt were noted too.

An analysis of the faunal elements recovered from Pisinimo was performed by Paul Johnson (1977) and is briefly summarized here. Eighty-two bone fragments were recovered, 51 of which were too fragmentary for identification. Most of the identified fragments (22) were from jackrabbit (*Lepus alleni*; *L. californicus*), with single elements from a kit fox (*Vulpes macrotis*), a roadrunner (*Geococcyx californianus*), a sage thrasher (*Oreoscoptes* (*Toxostoma*) cf. *montanus*), and an unidentified large bird. Five cow-sized elements were also identified. Noticeably lacking are any indications of large game animals such as deer, antelope, and bighorn sheep. The five cow-sized elements are ribs, found in association with the historic trash, and are probably from a domestic cow. The presence of the sage thrasher indicates a winter occupation at the site. However, as it was found on the site surface, it could easily be historic rather than prehistoric.

At Pisinimo a large number of shell specimens were scattered over the site surface. Alan Ferg has analyzed this collection (1977b), and his findings are briefly summarized. Seventy specimens of marine shell, representing nine species, were collected from Pisinimo. In decreasing order of frequency these species are *Glycymeris* sp. (42), *Laevicardium elatum* Sowerby (14); *Olivella dama* Wood (4), *Trachycardium panamense* Sowerby (2), *Pecten vodgesi* Arnold (1), *Anadara* sp. (1), *Chione* sp. (1), *Trivia solandri* Sowerby (1), *Theodoxus luteofasciatus* Miller (1), and three unidentified specimens.

Seven plain *Glycymeris* bracelet fragments, one unfinished *Glycymeris* ring fragment, two whole shell beads (*Trivia solandri* and *Theodoxus luteofasciatus*), and a bilobed bead of unidentified shell type constitute the finished (or nearly finished) shell jewelry at the site. Among the unworked specimens, the most notable are six large whole Glycymeris gigantea valves that were found in a cache eroding from the side of a small wash. At least one of these valves is a fossil shell, and perhaps all are.

As a result of his analysis, Ferg (1977b) made the following observations:

> Though a fair amount of shell was recovered, the information to be drawn from it is not great: (1) the proportions of the different bracelet types are typical of a Santa Cruz/Sacaton phase site, (2) a laterally perforated Trivia solandri bead was found, documenting the presence of this bead type in a Santa Cruz/Sacaton age Hohokam site, and (3) the presence of bracelet manufacture wastage and a cache of unworked Glycymeris gigantea valves indicate that shell working was being done at the site and that this site may have been on a Hohokam shell expedition trail of the sort documented by Hayden (1972).

These observations lead us directly to the question of how Pisinimo relates to the Hohokam occupancy of the Papagueria. Was Pisinimo a Hohokam campsite along a shell expedition trail, as Ferg suggests? Could it have been an agricultural camp or a base camp for hunting or wild plant gathering? Could Pisinimo have been a small seasonal or year-round village?

The substantial number of shell specimens indicates that shell procurement and shell jewelry manufacture were important activities for the occupants of Pisinimo. However, the quantity of other artifactual material at Pisinimo indicates that the site did not owe its existence solely to shell or salt gathering expeditions. In ethnographically described Papago salt expeditions (Underhill 1946: 211-232), the Papagos traveled as quickly as possible between their villages and the coast, staying but a single night at each campsite. This pattern was repeated on the homeward journey. Thus, campsites along the expedition routes would contain only ephemeral traces of habitation. If the Hohokam had followed a similar pattern, their campsites should also be unpretentious, consisting at most of a few scattered hearths and associated broken pottery, the latter mostly jars for water storage unless gourds were used instead. The shell gatherers would want to travel light to bring back as much shell as possible.

The presence of manos and handstones, a few large ceramic jars, two heavy artifact concentrations, and the occupation of the site in the transition between the Santa Cruz and Sacaton phases all suggest an occupation at Pisinimo that lasted several weeks or months in a given year, rather than overnight repeated visitation to the campsite each year for scores of years. The location of Pisinimo, near the center of a broad valley, argues against its being either a hunting camp or a wild plant gathering camp, as such camps would be expected much closer to the mountains (unless mesquite bean gathering were the major activity). The absence of large game animals in the faunal inventory and the absence of formalized hunting and butchering tools further preclude hunting as the major activity. The lack of trough metates and shaped rectangular manos suggests that agriculture did not play a major role either, though this inference is impossible to demonstrate because most of the handstones and manos are fragmentary.

I suspect that further testing will show Pisinimo to be at least a seasonal agricultural habitation site with greatest occupation during the efflorescence of Hohokam occupation in the transition between the Colonial and Sedentary periods. Several different types of activities most likely took place, and the small size of the sample obtained from this site has probably masked its agricultural nature. The fields around the modern Papago village of Pisinimo have been singled out as examples of floodwater farming in the Papagueria (Castetter and Bell 1942: 169). Systematic survey in this portion of the Quijotoa Valley may reveal many sites similar to the archeological site of Pisinimo and a settlement pattern not unlike that in the northern Santa Rosa Valley.

Sil Nakya

Sil Nakya (AZ AA:14:15) is an extensive prehistoric sherd and lithic scatter located a few miles northeast of the Comobabi Mountains (see Fig. 90), along Papago Route 34 between the modern Papago villages of Schuchk and Sil Nakya. The archeological site of Sil Nakya has two cultural/temporal components. One component is a transitional Colonial/Sedentary period village that covers an area of more than 45,000 sq. m. The other component is an isolated Archaic period projectile point of Amargosa II or early Chiricahua Cochise temporal horizons (identified by E. Jane

Rosenthal). It is not known how much of the extensive lithic scatter at Sil Nakya may be associated with this early horizon.

The ceramic-period component at Sil Nakya consists of a light scattering of sherds and lithics (approximately 1 to 10 artifacts per sq. m) throughout most of the site area, with occasional moderately dense (approximately 11 to 50 artifact per sq. m) concentrations of materials. None of these concentrations, however, match the density of cultural material seen in many of the deposits at Gu Achi. A single probable trash mound--a low mound of sherds and fire-cracked stone (seemingly devoid of other cultural remains)--was encountered at Sil Nakya. This mound was about .5 m in height and 15 m in diameter and had been disturbed by historic grazing activities.

Nine five-foot-square hand-excavated pits were placed in the northeastern periphery of the site in November 1978 to test the cultural depth and intensity of occupation. Cultural material did not extend to depth of 60 cm in any test pits, but several pits indicated a probable occupation surface 45 cm below the present ground level. At this particular depth one of the pits contained a hearth with a burned partial skull of a mule deer(?) and numerous sherds and lithics. Most other pits contained some subsurface cultural material, but not in notable quantities.

More than a thousand sherds were collected. A quick sorting by the author revealed only 28 decorated sherds, which probably constitutes no more than 2-3% of the total ceramic assemblage. Redware sherds were absent. All but one of the collected decorated sherds are buffwares. The single sherd was from an unidentified pre-Classic period red-on-brown jar. Eighteen of the buffware sherds are stylistically transitional between Santa Cruz and Sacaton Red-on-buff, one is Santa Cruz Red-on-buff, five are unidentifiable as to type, and three are undecorated. Bowl sherds outnumber jar sherds by more than 3 to 1, but this figure should be viewed cautiously because the sample size is so small. Two of the transitional Santa Cruz/Sacaton Red-on-buff bowl sherds may have been locally made. Their temper consists of a larger amount of coarse sand grains than is typical for this pottery type elsewhere, and both sherds exhibit a lustrous polish. The single red-on-brown jar sherd has a broad line design and a fine sand temper uncharacteristic of both Trincheras culture pottery and Tucson Basin ceramics. The other buffware sherds are macroscopically identical to those reported from the Gila Basin and even include a transitional Santa Cruz/Sacaton period jar sherd decorated with dancing human figures.

The plainware from Sil Nakya is not greatly different than that of either Gu Achi or Fisinimo. Schist-tempered specimens dominate the assemblage. As at Fisinimo, the platelets of schist are more finely ground and used more sparingly than is usual for this pottery type at Gu Achi. Sherds with altered andesitic(?) grus temper, sand-tempered specimens, and a few sherds of Gila Plain were also present. Sherds tempered with crushed altered andesite(?) were conspicuously absent. In general, jars, some apparently quite large, were the dominant vessel form. Fragments of large shallow bowls were also common.

The chipped stone assemblage is nearly identical in morphology to that of Fisinimo. Most frequently found at Sil Nakya are large, secondary decortication flakes that were occasionally utilized or unifacially retouched. Cores were also numerous; two exhibit secondary use as hammerstones. The most common chipped stone material type is a purplish-red rhyolite. A few specimens of fine-grained green rhyolite are also present. The matrix of the latter material type is similar to the green quartzite at Gu Achi, but the presence of large quartz phenocrysts in the Sil Nakya specimens clearly indicates a different source from that of the Gu Achi specimens.

Both manos and metates were noted in the initial survey of the site. However, none was collected during the testing program.

Bone was not common. In addition to the burned mule deer cranial fragment found in one of the test pits, a few elements from rabbits and long bone splinters from medium-sized artiodactyls (such as deer and sheep) constitute t[illegible]l assemblage. However, it is suspected that the proximity of Sil Nakya to the Comobabi Mountains would have encouraged the hunting of large game animals.

Perhaps the most noticeable difference between the cultural assemblage at Sil Nakya and that of both Gu Achi and Fisinimo is the lack of shell. A crude Glycymeris bracelet fragment was the only item of shell recovered during the testing program, and even the survey of the site revealed nothing more than a small number of bracelet fragments. Such a situation is more typical of Classic period sites in the Papagueria than pre-Classic period ones.

The location of Sil Nakya and the nature of the cultural assemblage raise several interesting questions and possibilities. Sil Nakya is situated at the juncture between an upper and lower bajada near the divide between the Aguirre and Santa Rosa Valleys. The nearest major wash, Aguirre Wash, is about eight miles northeast of the site, though a broad, sandy unnamed wash is only three miles to the east. Several small washes surround Sil Nakya, and floodwater farming could have been practiced near the site. Also, the proximity of both the site of Sil Nakya and the modern Papago village of Sil Nakya to the Comobabi Mountains is important. A free-flowing spring in the Comobabi Mountains is less than five miles from the site of Sil Nakya (U.S.G.S. Comobabi Quadrangle, 15', 1957), and several historic wells and dams are also in the area. Likewise, the modern Papago village of Sil Nakya some six miles to the west was founded at least by the early 1800's as the winter well village for the summer field village of Achi in the Santa Rosa Valley (Hackenberg 1964: II-103).

Thus, the location of prehistoric Sil Nakya makes it the best candidate that we now have for a pre-Classic period Papaguerian winter well village. Sil Nakya is near a possibly dependable supply of winter water, and the rugged Comobabi Mountains could have provided an excellent locale for hunting large game animals and for gathering certain upper elevation plants. The highest peak in the northern portion of the Comobabi Mountains rises to an elevation of 4788 feet, nearly 2500 feet higher than Sil Nakya.

It is very tempting to view Sil Nakya as a winter well village, thus extending the historic Papago model back to pre-Classic period Hohokam populations in the Papagueria. This would solve the critical question of how the large flood plain villages (such as Gu Achi and AA:1:66) would survive the waterless winter and spring months. If a summer field village-winter well village pattern was practiced by the Hohokam, villages such as Gu Achi would have been deserted in the fall and reoccupied after the first major spring rains.

There are, however, several problems in accepting Sil Nakya as a winter well village and in accepting the bilocational residence model in general for the pre-Classic period Hohokam. First, the sample of the work done thus far at Sil Nakya is small. The data obtained from the site represent a very small percentage of the total assemblage. I suspect that more detailed floral and faunal analyses will reveal that the site was occupied in the summer months, as is suggested by the physiographic suitability of the surrounding terrain for floodwater farming.

An even more critical problem is the absence of other suitable candidates for pre-Classic winter well villages. Historic Papago winter well villages were smaller and more numerous than their associated summer field villages. Summer field villages often had two or even three associated winter well villages into which their populations dispersed (Hackenberg 1964; Jones 1969). If the Hohokam had practiced a similar pattern, the chances are great that several such sites would have been found and recorded during the course of archeological work in the Papagueria. Such has not been the case. The pre-Classic period "base camps" found by Goodyear (1975) and Raab (1974, 1976) in the Slate Mountains and by Stewart and Teague (1974) in the Vekol Mountains are clearly not winter well village sites. Rather, the evidence seems to support the notion that the large pre-Classic period flood plain village sites, such as Gu Achi and AA:5:45, were occupied year round.

Quijotoa Valley Project

The Western Archeological Center carried out a major survey and testing program along Papago Indian Road (PIR) 1 in the western portion of the Papago Reservation between the fall of 1973 and the spring of 1975 (Rosenthal 1977a; Rosenthal and others 1978). A total of 42 sites was located along PIR 1. Twelve of these were tested, resulting in sizeable collections of artifacts from nine sites (Rosenthal and others 1978: Table 3). In addition, tests were conducted at Huihikiwani (AZ Z:11:5), an important site located on PIR 34 in the northwestern corner of the Papago Reservation (see Fig. 90). Since most of these sites are in the Quijotoa Valley, the survey and testing program was named "The Quijotoa Valley Project."

The 43 sites recorded during the initial survey (including Huihikiwani) included an historic road, historic Papago use areas (2) (one of which is not discussed in the 1978 report), a recent campsite of Mexican aliens, Sells phase settlements or use areas (8), multicomponent sites containing both pre-ceramic and ceramic period materials (3), undiagnostic lithic scatters (3), and sherd and lithic scatters containing either "Sonoran Brown Ware" or "Sells Plain" ceramics (25). Most of these sites probably date to the Sells phase, but it is conceivable that a few could be proto-historic or early historic Papago.

Five of the Sells phase village sites were tested. Three (AZ Z:11:6, AZ Z:14:30, and AZ Z:14:43) were single component (except for a single stray sherd of Snaketown Red-on-buff at AZ Z:11:6) while the other two (AZ Z:14:21, AZ Z:14:28) had some Sedentary period material. AZ Z:14:21 was interpreted as a transitional Sedentary/Classic period site. It was felt AZ Z:14:28 had separate Sells and Rincon phase components (Rosenthal and others 1978: 121-122, 212-215).

A single pit house and two burials, one a cremation and the other an extended inhumation, were excavated at Huihikiwani. These represent the major substantive features tested during the course of the Quijotoa Valley Project. Radiocarbon dates were obtained from charcoal associated with the cremation burials at Huihikiwani (Douglas R. Brown: personal communication) and a hearth at AZ Z:14:30.

All three of the sites with pre-ceramic components were tested. Two of these sites (AZ Z:14:33, SON C:2:15) contained materials classified by Rosenthal and others (1978) as "San Dieguito," suggested as being contemporary with the Ventana Complex of Ventana Cave (thus dating before 9000 B.C.). SON C:2:15 also had a small historic Papago component. AZ Z:14:33 contained an abundance of Archaic period projectile points (Amargosan I and II), a Sells phase village, Papago-like projectile points, and "prehistoric Papago" ceramics. AZ Z:14:33 is situated near Gu Vo Wash, a major tributary of San Simon Wash, which partially explains the intensity of occupation at this site. Immediately across Gu Vo Wash from AZ Z:14:33 is another site, AZ Z:14:32, that contains a sizeable Archaic (Amargosa II) component and a scattering of ceramic materials. The ceramics are primarily Lower Colorado Buff Ware of the Lowland Patayan ceramic tradition (see Waters in press).

dating to the Patayan ("Yuman") II period, roughly A.D. 1100-1500. Severson (1978) suggests that the abundance of Yuman ceramics at AZ Z:14:32 reflects either a Patayan occupation of the site or, more likely, the use of the site by Sand Papagos.

The remaining four sites that were tested (SON C:2:20, SON C:2:22, SON C:2:23, and SON C:2:25) had been identified during the initial survey as sherd and lithic scatters of unknown age. Testing and surface collecting revealed that these sites contain hearths and lithic materials that suggest plant gathering and processing activities. While little testing was performed at these sites, radiocarbon sampling of hearths at SON C:2:20 and SON C:2:22 yielded dates provocatively within the boundaries of the poorly known protohistoric period (circa A.D. 1450-1700).

Our understanding of these 43 sites is limited by two methodological factors. First, the major components of many of the sites lay outside the 100-foot-wide right-of-way, and time did not permit their adequate delineation. Also, the testing accomplished at most sites was not extensive. Only three (AZ Z:11:5, AZ Z:14:21, AZ Z:14:55) were subjected to the excavation of more than 100 sq. m of site surface area (196, 152, and 110 sq. m, respectively), and at most others fewer than 50 sq. m were tested. In several instances sites were sampled by means of small test squares. The problems of using such a sampling technique have been previously detailed for Gu Achi (Chapter 3) and for Yablon's work in the northern Santa Rosa Valley (this chapter). However, extensive surface collecting within the right-of-way of the Quijotoa Valley Project sites somewhat alleviated these problems and added considerably to our knowledge of each site.

Another somewhat disconcerting problem is that the report on the Quijotoa Valley Project (Rosenthal and others 1978) does not holistically treat individual sites. Each author discusses a different aspect of the project sites (for example shell, ceramics, architectural features), and little attempt is made to combine these varied aspects into a complete description of each site. In order to understand the nature of individual sites data must be gleaned from several different portions of the text. Such organization unfortunately has led to inconsistencies in the data presentation. Coe (1979), in a recent review of the project report, has detailed several of these problems. Nevertheless, the information obtained from the Quijotoa Valley Project provides important insights into the pre-ceramic Archaic and the ceramic period Sells phase populations of the Papagueria.

Two interrelated aspects of the Quijotoa Valley Project report deserve discussion here. These are the attempted reinterpretation and revision of Papaguerian chronology and the nature of the "Sonoran Brownware Tradition," the cultural label applied to the Sells phase sites.

Chronology. Four radiocarbon dates were processed from Huihikiwani (AZ Z:11:5) and from AZ Z:14:30, both sites considered to date to early in the Sells phase, prior to A.D. 1300 (Rosenthal and others 1978: 212-213). Two samples from the same hearth feature at Huihikiwani were processed by the Laboratory of Isotope Geochemistry at the University of Arizona. The dates obtained were A.D. 1020 ± 70 and A.D. 1080 ± 70. In addition a sample from a hearth at AZ:14:30 yielded a date of A.D. 1050 ± 70. Because of the general lack of pre-Sells phase ceramics, these hearths were assumed to date to the Sells phase, thus pushing back the inception of the Sells phase to A.D. 1050-1100, rather than the A.D. 1250 date postulated by Haury (Haury and others 1950: 6) or the A.D. 1150-1200 date posited in the present volume.

Several factors combine to suggest that the A.D. 1050-1100 date for the beginning of the Sells phase is too early. One is the nature of the archeological context of the two radiocarbon dated features. The hearth at Huihikiwani (where a green bone cremation was found in association) contained no temporally diagnostic artifacts. The only funerary object found with the cremation was an undateable Gila Plain bowl. Likewise, the hearth at AZ Z:14:30 had no dateable artifacts in direct association. Therefore, it is possible (though not likely) that these two features may be earlier than the remainder of the site assemblages. Our understanding of this situation is complicated by Severson's (1978: 122-125) discussion of the ceramics from AZ Z:14:30 wherein he mentions large numbers of sherds of Tanque Verde Red-on-brown and Sells Red. However, the table summarizing the sherd totals lists no decorated or redware ceramics from this site (Severson 1978: Table 7). I suspect the table is in error.

Another way to explain the dating discrepancy is to attribute the early dates to the use of long-dead wood in the hearth. While such an explanation is conceivable for one hearth, it seems unlikely that both hearths would exhibit the same phenomenon to the same extent. The same skepticism also applies to the explanation that both hearths are isolated features of earlier Sedentary period occupation in a sea of Sells phase materials.

Comparative evidence from other southern Arizona sites further weakens the likelihood of the A.D. 1050 date for the beginning of the Sells phase. An extensive series of archaeomagnetic dates obtained from Las Colinas in the Salt River Valley (Hammack 1969; Masse 1977), the Escalante Ruin Group in the Gila Valley (Doyel 1974; 1977a), and the Punta de Agua sites in the Tucson Basin (Greenleaf 1975a) indicate that the period between A.D. 1150-1200 was a period of considerable change in cultural patterns. The ceramic changes previously noted for the transition between the Sedentary and Classic periods were happening during this time period as well. The transitional pottery types Santan Red-on-buff and Cortaro Red-on-brown were in vogue until well after A.D. 1150. The earliest we can place "typical" Casa Grande Red-on-buff and "typical" Gila Red in the Hohokam core area is A.D. 1150-1175, and the earliest dating for "typical" Tanque Verde Red-on-brown in the Tucson Basin is A.D. 1200.

Severance has noted that the ceramic assemblages from Huihikiwani and AZ Z:14:30 contain Gila Red and "pristine" Tanque Verde Red-on-brown (1979:122). No sherds stylistically transitional between the Sedentary and Classic periods were recovered. Thus, if the dated Quijotoa Valley Project hearths are contemporaneous with the rest of the site assemblage and if the A.D. 1050-1100 dates do reflect the use of the hearths, then two conclusions are inescapable. First, there is a lag of at least 50-100 years in the appearance of identical items of material culture between the Papagueria and other regional Hohokam populations. Second, Papaguerian populations must have initiated the development of a substantial portion of the Classic period Hohokam core area and Tucson Basin ceramic types. Neither of these conclusions is supported by present evidence. The development of Tanque Verde Red-on-brown may have been initiated in the Papagueria, but certainly this did not take place much before A.D. 1150.

Other factors may lend support to my belief that the Sells phase did not begin before A.D. 1150. In addition to the two dates given above for the hearth at Huihikiwani, a third sample from this feature was processed by the Geochron Laboratories in Cambridge, Massachusetts. The resultant date was A.D. 1195 ± 123. While the sigma ranges of these three dates overlap between A.D. 1075-1090, the Geochron date does hint that the hearth may be more recent than the University of Arizona dates suggest.

The hearth at Huihikiwani appears to have been a primary cremation, a fact alluded to but not explicitly stated in the report (Brown 1978: 34-36). The fact that the skeleton was at least somewhat articulated, the distribution of charcoal and bones (Brown 1978: Fig. 8), the interesting differential burning of the skeleton itself (Shipman 1978), and the inversion of a bowl over the fragmented remains are nearly identical to Classic period primary cremations reported from the Gila Bend area (Wasley and Johnson 1965: 33-34, 66-67). The cremation at Huihikiwani was the first primary cremation recorded in the Papagueria. A second has since been reported by Huckell (1979) at a site northwest of Ajo.

In hopes that the dating of the practice of primary cremation would be of some help in assessing the dates from Huihikiwani, a scan was made of the literature for other known primary cremations in southern Arizona. Vessels of Gila Red and Gila Plain were found in association with the primary cremations from the Gila Bend area. Other pottery types associated with the sites in which these cremations were found include Tanque Verde Red-on-brown, Casa Grande Red-on-buff, and a few tree-ring dated intrusives from northern Arizona, all of which suggested to Wasley and Johnson (1965: [illegible]) that these sites dated after A.D. 1100. They indicated that a date of A.D. 1150 was reasonable for the inception of the Classic period, thus placing the practice of primary cremation also after A.D. 1150.

Primary cremations have also been noted in the Tucson phase (approx. A.D. 1300-1400) at the Rabid Ruin Site in the Tucson Basin (Hammack 1969), at the Ringo Site, dating between A.D. 1250-1350 (Johnson and Thompson 1963), and at the Kuykendall site probably after A.D. 1300 (Mills and Mills 1969). These occurrences strongly indicate a post-A.D. 1150 date for primary cremation. The single exception (and perhaps an important one) is the Trincheras culture site of La Playa (Johnson 1960, 1963). Two primary cremations found at this site probably date before A.D. 1100. However, no diagnostic artifacts were recovered from the cremations, and therefore the dating is somewhat questionable.

A final argument regarding the dating of the Sells phase directly concerns the relationship between the Sells phase populations and the pre-Classic period Hohokam in the Papagueria. If the inception of the Sells phase truly dates to around A.D. 1050, this implies at least some temporal overlap between the two populations. This is especially true if the transitional pottery type Topawa Red-on-brown is produced throughout the "Topawa Phase," and if it is an early variant of Tanque Verde Red-on-brown, as is suggested by Severson (1974: 109). Rosenthal and others project the beginning of the "Topawa Phase" back to A.D. 900 (1978: 19, 213). Apparently their justification for doing so was that since the beginning of the Sells phase had been pushed back from A.D. 1250 (Haury and others 1950) to A.D. 1050, then the beginning of the "Topawa phase" must likewise be pushed back 200 years (A.D. 1100 to A.D. 900). If such were indeed the case, the A.D. 900 date indicates that for at least 150 years "early Classic period"-like (Topawa phase) populations were neighbors to Sedentary period Hohokam populations at sites such as Gu Achi and AA:5:43. In addition, an A.D. 900 date for the beginning of the Topawa phase would place the beginnings of a transitional Sedentary/Classic period ceramic assemblage fully 250 years in advance of such assemblages in the Hohokam core area and the Tucson Basin. However, it is reemphasized that, on the basis of archaeomagnetic dates, Topawa Red-on-brown ceramics do not appear in the Tucson Basin before A.D. 1200 (Greenleaf 1975a: 54). Also, none of the large Hohokam villages in the Papagueria, such as Gu Achi, exhibit Topawa or Sells phase materials in direct association with pre-Classic period remains. These facts combine to suggest that the postulated A.D. 900 and A.D. 1050-1100 dates for the inception of the Topawa and Sells phases, respectively, are much too early.

The dating of protohistoric or early historic Quijotoa Valley Project sites seems more secure than that of the earlier Sells phase. A small series of radiocarbon samples was obtained from hearths at SON C:2:20 and

SON C:2:22. Two hearths were sampled at SON C:2:22 with the resultant dates of A.D. 1740 ± 80 (A.D. 1660-1820) and A.D. 1610 ± 90 (A.D. 1520-1700). In addition, three samples were obtained from a single hearth at [illegible]. Two of these were processed by the University of Arizona (Arnold 1978) and resulted in dates of A.D. 1580 ± 90 (A.D. 1490-1670) and A.D. 1610 ± 80 (A.D. 1530-1690). The third sample from this hearth was processed by Geochron Laboratories (Krueger 1978) and produced a date of A.D. 1829 ± 125 (A.D. 1700-present). The discrepancy between this date and the University of Arizona dates is not presently understood, but the bulk of the evidence appears to support the protohistoric dating of the hearths.

Sonoran Brownware Tradition. In an attempt to provide a cultural framework in which to place their Sells phase sites, Rosenthal and others (1978) utilize Ezell's (1954, 1955) previously discussed concept of the "Sonoran Brownware Tradition." Their use of this concept is best illustrated in the following quote (Rosenthal and others 1978: 215):

> The Quijotoa Valley Project sites differ from both the Gila-Salt sites and the villages along the Santa Rosa Wash. Ceramics and stone tools are distinctively made, and houses, when present, are unlike Classic period structures. Ezell has defined this situation as the Sonoran Brownware Tradition. To expand on his presentation (with due credit to DiPeso (1956) and Hayden (1970), who have presented similar notions), it appears that the local cultural tradition present in the Papagueria is influenced by the Trincheras people to the south, the Hohokam to the north and the Yuman to the west. These influences may be observed in ceramic and shell styles at our sites. Strongest contacts appear to be with the Yuman people, documented by their intrusive ceramics.
>
> "Sonoran Brownware Tradition" is a rural lifestyle reflected in roughly shaped ground stone, in simple flake tools and, most importantly, in igneous clay ceramics. There are no canals or reservoirs, deliberate cremation, elaboration of ornaments, votives or the like. This rural lifestyle was first identified at Valshni Village (where Trincheras and Hohokam tradewares are found) and existed contemporaneously with Hohokam sites in the Papagueria, such as Gu Achi, Pisinimo and Lost City. The Papaguerian Sonoran Brownware Tradition does not appear to evolve from Red-on-buff colonizers (Gila-Salt Hohokam) through a gradual shift in tool mediums, but appears to be distinct from its

> inception onwards. This perspective unites in one tradition archeological cultures, in the Tucson Basin as well as in southern and western portions of the modern Papago reservation, which share similar technologies.

The authors of the Quijotoa Valley Project report are correct in pointing out the fact that significant differences exist between their sites and those of either the Santa Rosa Wash (such as AA:5:43) or the Gila and Salt River Valleys. However, it seems apparent that there are several inconsistencies in assigning these sites to the Sonoran Brownware Tradition and in interpreting this "cultural" tradition.

A major area of concern is the implicit equation of pottery traditions with cultural traditions. In Severson's (1978: 128-134) discussion of the ceramics, the pre-Classic Tucson Basin types Rillito and Rincon Red-on-brown are lumped together with Ezell's previously defined Sonoran Brownware pottery types. Also, the non-micaceous plainware of the Tucson Basin is suggested to be the Sells Plain of the Sonoran Brownware Tradition because volcanic rock fragments are found in the sand temper. Thus, principally on the basis of ceramics, the pre-Classic Tucson Basin populations are postulated as belonging to the Sonoran Brownware Tradition. When these assertions are coupled with the meaning of the statements quoted above, it seems logical to conclude (1) that the pre-Classic Tucson Basin populations were not Hohokam (compare Kelly 1978; Masse in press a); and (2) that since "Sells Plain" (that is sand-tempered and altered andesitic(?) grus-tempered plainware) was a major component of the Gu Achi ceramic assemblage, the occupants of the site were of Sonoran Brownware heritage rather than Hohokam. By extension since most regional Hohokam populations made pottery tempered with sand containing occasional volcanic rock fragments, the argument could be made that all belong to the Sonoran Brownware Tradition (see Masse n.d.b). These conclusions, of course, can be strongly contended.

While the ceramic analysis seems basically sound, a few minor problems are present. Severson (1978: 103) states that Tanque Verde Red-on-brown pottery may last later than A.D. 1500 according to Franklin and Masse (1976: 40). Such a statement was never made by Franklin and Masse (1976). Another misinterpretation of a reference is the use of the term "grog" (Shepard 1956) to refer to any nonplastic material added to clay as temper (Severson 1978:

98). Shepard's original statement (1956: 25) strongly indicates her preference of reserving this term to "ground brick, tile and other fired products."

Severson suggests (1978: 121) that a "rhyolite"-tempered sherd had been incised in a manner similar to that of Gila Butte Red-on-buff. Examination of the sherd by this author, however, indicates that it was "scored" by a brush bundle, probably as part of the vessel wall thinning process. Further, while Severson (1978: 120) points out that the rhyolite-tempered plainware was classified by Ezell (1954) as "Wingfield Plain," Hayden suggests (personal communication) that it may belong to the Lower Colorado Tradition. However, as this rhyolite-tempered plainware is the same as the crushed altered andesite(?) from Gu Achi, neither interpretation may be entirely correct.

Severson notes that both coil-and-scrape and paddle-and-anvil thinning techniques are present in Sells Plain (1978: 101) and in the Yuman wares (1978: 119-120). In a large Yuman (Patayan) site excavated by Haskell (1979), all plainwares were paddle-and-anvil. Likewise, the "Sells Plain" at Gu Achi was paddle-and-anvil. Possibly, the sizeable numbers of coil-and-scrape specimens in the Quijotoa Valley Project collections may represent meaningful cultural, temporal, or regional variations.

Another puzzling feature of the Sonoran Brownware Tradition as defined in the Quijotoa Valley Project report is the description of its "rural life-style." The authors state there was not deliberate cremation, and yet Hal-hikiwani contained one. Also in this regard, if the Tucson Basin is to be considered a part of the Sonoran Brownware Tradition, the richness of several Classic period cremations (see Doyel 1979; Hammack 1978) then becomes anomalous. Also, at least one major Classic period runoff irrigation canal system has been reported in the Papagueria (Joseph, Spicer, and Chesky 1949: 15), and others will most likely be discovered in the future. Finally, it is difficult to understand how the "Sonoran Brownware Tradition" can be considered "rural" when platform mounds, compound walls, and Pueblo-like architecture are present in sites such as Jackrabbit Ruin (Scantling 1940), University Indian Ruin (Hayden 1957), and Martinez Hill (Gabel 1931; Doyel 1979: personal communication).

While most likely correctly identifying the Sells phase sites as "semi-permanent villages" and while admitting the difficulties of interpretation because of the small sample obtained (Rosenthal and others 1978: 219), the authors of the Quijotoa Valley Project report seemingly fail to consider the possiblity that large Sells phase villages such as Jackrabbit Ruin may exist in the unsampled portions of the Quijotoa Valley. Likewise, a check of the location of the project sites on U.S.G.S. topographic maps indicates that the project right-of-way, in the main, lies near the flanks of the mountain masses. There is reason to suspect that many pre-Classic Hohokam sites, such as Pisinimo, are present near the valley floors, and that the pattern of settlement in the Quijotoa Valley is not drastically different from that of the Santa Rosa Valley.

In this regard Rosenthal and others (1978: 220) note the proliferation of sites during Classic period times. This increase may not result from an increase in population, but may be due to the nature of the right-of-way sample or to the use of periodically shifting seasonal agricultural or wild plant processing camps by the Sells phase populations. At least some of the Quijotoa Valley Project sites appear to fall into the latter category.

The concept of the Sonoran Brownware Tradition posited in the Quijotoa Valley Project report, like the Desert Branch Hohokam concept, seems based on too small a regional sample of sites, which span only a relatively short period of time (about A.D. 1150-1300). It is possible that sites such as Valshni Village contain elements from a local population indigenous to the Papagueria, but until more evidence of such a situation is obtained, we should avoid the use of the Sonora Brownware Tradition as a cultural label.

Regardless of possible errors of interpretation concerning the Quijotoa Valley Project sites, many tantalizing bits of information were obtained and important questions were raised in the project report. One of the most interesting aspects of the Sells phase sites is that several, most notably AZ Z:14:21 and AZ Z:14:33, contained large numbers of marine shell. Most of the specimens at these sites are debris from shell jewelry manufacture. This situation contrasts with Jackrabbit Ruin, Ash Hill, and the Sells phase loci at Gu Achi where shell is rare. Rosenthal (Rosenthal and others 1978: 207) speculates that the Quijotoa Valley sites were either located along a shell trade route or perhaps were part of a Papaguerian shell exchange system. An important problem for future research is that of explaining why some Classic period sites have an abundance of shell while others have only a few specimens.

Small Projects Between 1975-1977

A series of small road right-of-way surveys in several different portions of the Papago Reservation in 1975 was conducted and briefly reported on by the Western Archeological Center ([illegible] 1975). Most sites located by these surveys were recent historic, but several prehistoric sites were also noted. Three of these (Comobabi 13, south of Sil Nakya; Hotason Vo 4, southwest of Huihikiwani; and Pan Tak 2, southeast of Sil Nakya) are sizeable Sells phase sherd and lithic scatters that probably represent agricultural sites or small villages. All these are located near the base of mountains and are typical of sites previously described. Hotason Vo 4 was subsequently tested by the Arizona State Museum in 1977 (Vogler 1978).

A large rhyolite quarry of probable prehistoric age (San Pedro 1) was located southeast of Sil Nakya. The site consists of numerous tested cores and some primary flakes. Tool making does not appear to have been accomplished at the site.

Approximately 10 miles southwest of Huihikiwani is an area of at least 133 bedrock metates that covers the tops and sides of a basalt outcrop next to a sizeable wash. Designated Hotason Vo 2, this is by far the largest concentration of bedrock metates reported in the Papaguería and seems to indicate that a special resource attracted people to this area for in situ processing. However, there are no indications of the nature of the resource. Wild plant gathering, floodwater agriculture, and hunting are all possibilities, considering the physical situation of the site. Whether the large number of metates reflects visitation by a small number of people over a long period of time, or whether it is the product of communal activities is unknown. Unfortunately, the associated artifacts were limited to a "few manos, flakes, and plainware sherds" of unidentified types. Additional survey in the vicinity is needed before the meaning of this site can be adequately assessed.

Another notable site (Cowlic 2) recorded during the 1975 right-of-way surveys (Somers 1975) is a large area of sherd and lithic scatters located a few miles west of Sells and close to Sells Wash and the Papago village of Big Fields (Gu Oidak). This site contains at least 14 sherd and lithic concentrations spread out over an area of 750,000 sq. m. Manos, metates, chipped stone tools, part of a stone ax, and one piece of shell were noted along with ceramics. Type names were not given to the ceramics, and cultural affiliations were not tendered for the site itself. However, the ceramic collection spanned the period of A.D. 900-1450. A possible prehistoric canal traverses the site area.

Although the site was not reported in enough detail to adequately assess its significance, the number and distribution of artifact concentrations suggest a pattern similar to that of Gu Achi and the Santa Rosa Valley in general. Because only a single piece of shell was observed in the survey, most of the site may date to the Sells phase. If such is the case, then the artifact concentrations may represent agricultural camps such as those described for Gu Achi.

Final testing was done at a small prehistoric sherd and lithic scatter located in the south Comobabi Mountains near the modern village of Comobabi (Rosenthal 1977b). This site probably indicates a resource utilization pattern similar to that noted by Goodyear (1975) for the Slate Mountains. The ceramics were all undiagnostic plainwares, but personal inspection by the author suggests they may date to the Sells phase. A few fragments of ground stone, chipped stone and core debitage, and a large number of chipped stone tools (15 out of a total of 135 artifacts) were also recovered.

Miscellaneous Survey and Testing Contract Research Programs

The Arizona State Museum conducted several recent surveys in the Papagueria, two of which have resulted in test excavations. One survey was conducted along an 11.75 mile long right-of-way for PIR 21 south of Pisinimo (Ferg and Vogler 1977). Seven small sites and numerous isolated sherds and lithics were observed. The seven sites exhibited a mixture of Archaic, historic, and unidentified prehistoric ceramic-period materials. Only one of the sites, SON C:3:2, seemed to be significant. The other sites were disturbed, and the artifacts were widely scattered. SON C:3:2, however, exhibited a fairly dense concentration of sherds and lithics covering an area of approximaely 5525 sq. m. The site lies on a gravel bajada between two washes.

SON C:3:2 was surface collected, and test excavations were done (Vogler 1978). About 40% of the site surface was collected, and eight excavation grids, constituting 18 sq. m, were selected for excavation. The artifacts recovered were 564 sherds (including Sells Red, but no identifiable decorated sherds), 3 fragments of ground stone (two manos and a possible basin metate), 97 pieces of debitage, 9 cores, 13 chipped stone tools, and two unworked fragments of Laevicardium. The only feature encountered was a hearth filled with fire-cracked rocks. This had been partially exposed by erosion. Nearly all artifactual material was confined to within 15 cm of the present ground surface.

SON C:3:2 may have been a seasonally occupied site that served as a campsite during plant procurement activities and possibly during plant processing as well. Except for the limited amount of ground stone and the absence of hammerstones (for metate resharpening?), this site bears strong resemblance to the Sells phase processing camps at Gu Achi.

AZ Z:14:47 (Hotason Vo 4) in the western portion of the Papago Indian Reservation was also tested (Vogler 1978). As mentioned, the original 1975 survey by the Western Archeological Center had indicated that AZ Z:14:47 was possibly a Sells phase village site. Testing did not confirm this hypothesis. The site extended over an area of approximately 21,000 sq. m; eight percent (1650 sq. m) of the most densely concentrated area was surface collected. Eight test pits were excavated in the site (10 sq. m of surface area). Most of these test pits were placed over visible surface features such as rock alignments and presumed hearths.

AZ Z:14:47 was primarily a surface site, with little evidence of material culture below a depth of 10 cm. A total of 519 sherds was recovered from the site. Surprisingly, decorated sherds were common, with 21 possible sherds of Tanque Verde Red-on-brown (4%) and 18 possible sherds of Gila Polychrome (3%). No attempt was made to estimate the number of vessels represented by these sherds, but these specimens were spread out over 40 sq. m and thus could have come from single vessels of each type. Seventeen sherds of Sells Red (3%) were the only other non-plainware sherd specimens found. Other artifacts include 190 pieces of chipped stone debitage, 14 cores, 32 chipped stone tools, two hammerstones, and five fragments of ground stone. Two worked fragments of Laevicardium were also found.

Testing of surface features revealed three extramural hearths. One contained just ash and charcoal, but the others also contained fire-cracked rocks. Another feature was a roughly circular area, 1 m in diameter, formed by a cluster of large flat stones and some smaller rounded cobbles. No ash or charcoal was present, nor were the stones burned. A functional interpretation was not given to this feature, but it is not unlike stone platforms reported from the Santa Cruz Valley in association with late prehistoric or early historic sites (DiPeso 1956: Plate 43; Doyel 1977b: Figure 67). DiPeso (1956: 144) has suggested that such structures may have served as the foundations for large granary storage baskets. The final features noted at AZ Z:14:47 are two rings of stone, roughly 1.5 m in inside diameter. One of these has stones around its entire perimeter while the other is just a partial ring. These features were interpreted as windbreaks or temporary shelters ("sleeping circles").

AZ Z:14:47 appears to be a major late Sells phase seasonal plant procurement and processing camp, much like those at Gu Achi and elsewhere in the Papagueria. Both wild plants and domesticated crops could have been the focus of activities. The relationship of this site to Hotason 2, mentioned above, remains an important problem for future research.

Another survey program by the Arizona State Museum examined two well locations and associated access roads just south of the Sand Tank Mountains and southeast of the Sauceda Mountains (McGuire and Mayro 1978). The well locations are near the modern Papago villages of Kaka and Stoa Pitk, a few miles northwest of the Castle Mountains and Ventana Cave.

Fourteen sites were recorded, including one Archaic site, two historic Papago sites, one isolated rock pile, and 10 prehistoric sherd and lithic scatters--three of which contained historic Papago components. These 10 sherd and lithic scatters are, in many respects, identical to the loci at Gu Achi and in the northern Santa Rosa Valley in general. Five sherd and lithic scatters and the isolated rock pile were located near Kaka. Three sherd and lithic scatters, all dating to the Sells phase, clustered in an area approximately 3/4 mile in diameter. These sites ranged in size from 250 sq. m to 20,736 sq. m. The large numbers of tabular tools, some ground stone, chipped stone tools, and ceramics, coupled with the physical setting of a broad, flat valley bottom, suggest plant processing, probably associated with agriculture. A fourth site (AZ Z:7:4), located about 1 1/2 miles away, covered an area of approximately 75,900 sq. m with a light (2-10 per sq. m) artifact scatter containing two major concentrations of material. Ground stone and marine shell manufacturing debitage were present, but no decorated pottery was noted. The absence of buffware sherds in such a large site suggests that the site dates to the Sells phase. However, the unusual quantity of marine shell debitage may not support such a conclusion.

The final site (AZ Z:7:11) near Kaka contains both a prehistoric and historic component in an area of 3600 sq. m. Four artifact concentrations were observed and perhaps represent trash dumping localities. Sherds of Papago Plain (including several with rim coils) were found in association with the prehistoric types, Wingfield Plain and an unidentifiable red-on-buff (2 sherds). On the basis of this association, McGuire and Mayro (1978) speculated that AZ Z:7:11 may have been a single component site occupied sometime in the protohistoric period. However, I suggest that the two buffware sherds more likely date from the Hohokam pre-Classic period than the Classic period because generally Casa Grande Red-on-buff occurs much more rarely than pre-Classic buffwares in the Papagueria, and, when it does occur, Tanque Verde Red-on-brown is nearly always associated with it. Also, the presence of rim-coiled sherds in Papago pottery may not be much earlier than A.D. 1700 (Masse 1979). If these observations are valid, then two temporal components are indicated.

The isolated rock pile near Kaka and two other rock piles located at AZ Z:7:6 may be similar in function to the rock piles noted in the vicinity of Gu Achi.

The sites near Stoa Pitk cluster in an area about 3/4 mile in diameter. They range in size from 1600-120,400 sq. m, with the middle range between 22,400 and 43,000 sq. m. The largest site, AZ Z:8:1, exhibits considerable time depth. The northeastern portion of this site contained several historic Papago houses and a fairly dense concentration of Sells phase material. Tanque Verde Red-on-brown pottery, large numbers of chipped stone tools, a diversity of ground stone, and a considerable amount of marine shell manufacturing debitage suggest this is at least a major seasonal processing area and quite probably a village. The western portion of AZ Z:6:1 contained an abundance of material that appeared to be pre-Classic Hohokam. This portion of the site seems to have been used for major seasonal occupation as well. A single sherd of Gila Butte Red-on-buff and several buff-ware sherds were found, along with numerous pieces of ground stone, tabular knives, chipped stone tools, and marine shell manufacture waste. Surface features included a roasting pit, three grinding stations, and two small piles of unmodified cobbles. As at Gu Achi, several fragments of isolated trough metates were noted in the vicinity of AZ Z:6:1.

The next largest site, AZ Z:6:4, is a dual component pre-Classic Hohokam village(?) and historic Papago site. Ten concentrations of artifacts were noted; eight contained sherds of Santa Cruz and Sacaton Red-on-buff. Ground stone and chipped stone specimens were in abundance. Marine shell items were common and included three large unmodified *Glycymeris* shells, a few whole or broken finished artifacts, and much debitage.

The three smallest sites exhibited similar types of manifestations, but in less quantity and with fewer decorated ceramics. The only decorated ceramic type at two sites was Trincheras Purple-on-red (representing one vessel from each site). One of the sites (AZ Z:6:6) had twelves piles of rock on the surface, some of which had been subject to burning, but most had not. Another site (AZ Z:6:5) had six widely scattered piles of unmodified cobbles, with the number of cobbles for each pile ranging from about 30 to 75. Once again this suggests a similarity to the rock piles near Gu Achi.

McGuire and Mayro (1978) suggest that many of these sherd and lithic scatters may have been the product of agricultural exploitation. To emphasize this point they singled out the large number of modern Papago fields in the Stoa Pitk and Kaka area. There is no reason to doubt this hypothesis, and it should be clear that these sites and those at Gu Achi and in the Santa Rosa Valley are also part of a similar phenomenon.

McGuire and Mayro suggest, interestingly, that the abundance of shell at some of these sites, especially manufacture waste, indicates that the sites were active participants in southern Arizona shell trade and exchange for the sites in the Papagueria may have contributed greatly to their survival because (during crop shortages, for example) shell could be traded to the Gila River Hohokam in exchange for certain subsistence goods (Randall McGuire 1978: personal communication). This is an interesting hypothesis, but one that is very difficult to test. As discussed in Chapter 4, exchange of subsistence goods is difficult to substantiate archaeologically. Also, while shell exchange for subsistence goods may have taken place between the Papageurian and core area Hohokam populations, it is doubtful that this exchange was regularized to the extent that it was necessary for survival.

Recently, a survey and testing program was performed on the Luke Air Force Base some 18 miles northwest of Ajo (Huckell 1979). Three sites, a small Archaic site and a small and a large sherd and lithic scatter of probable Patayan (prehistoric Yuman) affiliation were tested.

The Archaic site, AZ Y:8:2, yielded only a small amount of material, including four probable hearths and a light scattering of chipped and ground stone artifacts. A single projectile point of probable Amargosa II (late Archaic) derivation was also found. The most significant aspect of the site is a radiocarbon sample obtained from one of the hearths. This sample, processed by the University of Georgia Center for Applied Isotope Studies, yielded a date of A.D. 175 ± 190 (15 B.C. - A.D. 365). If this date accurately reflects the use of the hearth, then the A.D. 300 date suggested earlier as the possible termination of the Archaic period in the Papagueria is somewhat tentatively substantiated.

The small Patayan site, AZ Y:8:1, consisted of two temporally discrete occupations, probably camping episodes. One component consisted of three eroding hearths and an associated sherd and lithic scatter containing Patayan I ceramics. The second component consisted of three hearths and a primary cremation. The significant aspect of this site is the possible association of Classic period ceramics (post-A.D. 1150-1200) with ceramics assigned to the Patayan I period (pre-A.D. 1050). Specifically, a jar of Tanque Verde Red-on-brown was found in proximity to a jar of Colorado Beige near the cremation, and a Tonto Polychrome (post-A.D. 1300) bowl was directly in association in one of the hearths with a bowl of Colorado Red (Waters in press). The presence of the primary cremation, the Tanque Verde Red-on-brown jar, and Tonto Polychrome bowl suggested that the occupants of this component were late Classic period "Hohokam-related" (that is, late Sells phase) rather than Patayan. The most important aspect of this assemblage is the seeming contemporaneity between supposedly temporally discrete ceramic traditions. Huckell (1979) suggests that this indicates two possibilities: Either (1) Classic period wares were actually first manufactured much earlier than is commonly believed (thus supporting the contention by Rosenthal and others (1978) that the inception of the Sells phase should be pushed back to the 11th century A.D.), or (2) the A.D. 1050 termination of Patayan I ceramics suggested by Waters (in press) is too early. Huckell does not choose between these alternatives, but, for reasons presented in the discussion of the Quijotoa Valley Project, a more recent termination of the Patayan I period seems to me to be the more logical alternative. Also, for reasons indicated elsewhere (Masse n.d.b), several aspects of Patayan I ceramics more closely reflect ties with Classic period Hohokam ceramic assemblages than pre-Classic ones. The most striking similarities include the importance of redware, the presence of a high shoulder (the "Colorado shoulder"), and some tall conical neck forms.

The largest of the three investigated sites, the Lago Seco site (AZ Y:8:3), is immense. Numerous artifact concentrations dot an area of more than 1,000,000 sq. m (1 km^2). The site is located in a broad, flat, desolate valley, which before Huckell's work was considered to be largely devoid of major archeological manifestations. However, the Lago Seco site (as the name implies) lies at the margins of the dry playa of a large Pleistocene lake. Huckell suspects that a small lake may have existed during the prehistoric occupation of the site and implies that conditions were more mesic than at present. Such a situation is certainly possible since the presence of a reliable water source would have been necessary for the intensity of occupation that is apparent at the site.

Features encountered during testing included seven hearths, two major sherd and lithic concentrations, and an activity surface containing a large pit. These features take on added significance because only a very small percentage of the site was tested. The ceramics from the Lago Seco site show the same temporal mix noted for AZ Y:8:1. The great bulk of the ceramics are the Patayan I types--Colorado Beige, Colorado Red, and Colorado Red-on-beige. A few pre-Classic period Hohokam buffwares (Santa Cruz or Sacaton Red-on-buff) were also located. However, also present were small numbers of the Classic period Sells phase types Tanque Verde Red-on-brown and Sells Red. These were not clustered in any meaningful way; thus, it could not be determined if they represented a temporally discrete occupation or were contemporary with the Patayan I ceramics.

A hearth, a pit, and one of the sherd and lithic concentrations yielded enough charcoal for radiocarbon dates. The hearth was dated at A.D. 1535 ± 60 (A.D. 1475-1595), placing its use in the Protohistoric period. However, the presence of a Patayan I period jar in association with the hearth suggests that the radiocarbon date may be too recent.

The pit and the sherd and lithic concentration yielded dates of A.D. 1050 ± 65 (A.D. 985-1115) and A.D. 1015 ± 85 (A.D. 930-1100, respectively). If the Classic period ceramics are indeed contemporary with the Patayan I ceramics, this again raises the possibility that the Sells phase began earlier than believed. It is interesting that these two dates so closely approximated the dating of the Quijotoa Valley Project sites (Rosenthal and others 1978), but unless future work produces similar dates for Classic period ceramics, a date of A.D. 1150-1200 is still most convincing for the beginning of the Classic period.

The quantity and wide range of artifact types at the Lago Seco site led Huckell to speculate that a large social group occupied the site at least seasonally and participated in a number of activities, including hunting and gathering and possibly agriculture. Significantly, the material culture at the site includes more than 700 pieces of shell, of which more than 75% were pieces of Glycymeris jewelry or debitage (Huckell and Huckell 1979). If the cultural affiliation of AZ Y:8:3 is Patayan as Huckell believes, then it would appear that the Patayans as well as the Hohokam were involved in shell trade or exchange. Such a possibility had not previously been considered for the Patayan culture.

In the shell assemblage were 10 *Glycymeris* cores fashioned by the grinding-faceted technique. Huckell and Huckell (1979) note that this technique of bracelet manufacture seems to be a Papaguerian phenomenon, thus supporting the conclusions reached earlier by Ferg and reported in Appendix E of this volume.

There is a critical need for detailed study of shell distribution patterns for the Hohokam, Trincheras, and Patayan cultures. Such study may help to explicate trade and exchange patterns and possibly even identify low status vs. high status Papaguerian villages if such were present. However, before such patterns can be clearly established, more sites with large shell assemblages need to be studied, and better chronological control needs to be developed to perceive temporal changes in these patterns.

A final point concerning the project on Luke Air Force Base is the nature of the relationship between the Patayan I (A.D. 500-1050) populations and Patayan II (A.D. 1050-1500). Huckell (1979) has suggested that there are enough differences in material culture between these two periods that there is reason to suspect the cultural linkage between them; thus, the Patayan I groups are not directly ancestral to the historic Yumans. The present data base does not provide a clear resolution to this problem. However, if the two temporal populations are culturally distinct, then it is of major significance that the Patayan I populations "disappear" at roughly the same time that most of the Papagueria is abandoned by the Hohokam.

Brief mention will be made of one final project in the Papagueria. Recently, during the course of a survey near Gila Bend, a local amateur indicated to archeologists from the Arizona State Museum that he knew where some Pioneer period sites were located nearby. As a result two Hohokam village sites were located on the northern flanks of the Sand Tank Mountains in an upper bajada pediment (Lynn S. Teague 1979: personal communication). Both sites contained pit house depressions (at least 8 or 10 at one site), cremations, and abundant ceramic evidence of occupation from the Snaketown through Santa Cruz phases. No Sacaton phase ceramics were noted. No dry farming features were noted around the sites, but nearby washes would have been well suited for agriculture.

These sites are located in the mountain flanks where no village sites would be expected. Also, it is clear that these sites were initially occupied during the Snaketown phase; this is unusual because only one or two Pioneer period sites have been previously reported from the general Gila Bend area. Finally, evidence for occupation stops abruptly in the middle of the Santa Cruz phase, just at the time when the Hohokam culture began to expand its boundaries and intensify economic and social relationships in all of southern Arizona.

* * *

This concludes our lengthy discussion of archeological projects in the Papagueria. It is obvious that what was once considered a "dismal" and "desolate" land is archeologically extremely rich, containing at least 12,000 years of fascinating and complex culture history. At the same time major gaps exist in our understanding of Papaguerian archeology and our present picture is imperfect at best. It is the task of Chapter 7 to organize the data presented here into a coherent, if tentative, framework.

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Chapter 7

THE HOHOKAM IN THE PAPAGUERIA: A NEW SYNTHESIS

> It is a hard thing to close up a discourse and to
> cut it short, when you are once in, and have a
> great deal more to say. There is nothing wherein
> the strength and breeding of a horse is so much
> seen as in a round, graceful, and sudden stop.
>
> Montaigne

By this point the reader has been subjected to a tremendous amount of data on the archeology of Gu Achi and the Papagueria. Ideally we should pay heed to the wisdom of Montaigne and bring this volume to a terse ending, summarizing in a few short paragraphs our revised chronology and conception of the Hohokam in the Papagueria. This chapter does, in fact, attempt to summarize some of the major points discussed in earlier chapters; however, two obstacles prevent a short and graceful conclusion. First, the sheer mass of material presented here makes total assimilation and understanding difficult, if not impossible. Second, while this chapter is somewhat presumptuously entitled ". . . A New Synthesis," in no respect can the synthesis presented here be considered the final word on the Papaguerian Hohokam. The pace of Papaguerian archeology is accelerating so rapidly that much of this synthesis will be amplified, revised, or discarded over the next few years. Nevertheless, an intriguing, if somewhat hazy, picture of the Hohokam in the Papagueria can be extracted from this mass of data.

This chapter is divided into two sections, one a discussion of the status of the "Desert Branch Hohokam" concept, and the other a chronological scenario highlighting the known major aspects of Hohokam occupation of the Papagueria.

Rethinking the Desert Branch Hohokam Concept

Throughout this volume the "Desert Branch Hohokam" concept (Haury and others 1950: 14-15, 546-548) has been repeatedly criticized and its validity questioned. However, the reasons for such criticism have not yet been coherently and concisely presented in this volume; likewise, a workable alternative for the Desert Branch Hohokam concept has yet to be outlined. This discussion attempts to provide a new framework that should enable us to understand the nature of the prehistoric occupation of the Papagueria region.

The Desert Branch Hohokam concept was formulated as an initial attempt to explain the apparent variability between contemporary populations living in the Papagueria and the Hohokam "core area" of the Gila and Salt River Valleys and the Tucson Basin. Briefly stated, this concept envisioned the rise of the Hohokam from indigenous Archaic populations, with the Papagueria and the Hohokam core area reflecting a similar degree of cultural development during the Pioneer period. By the Santa Cruz ("Topawa") phase, both minor and major material culture differences began to appear between the two regional Hohokam populations. After A.D. 1000, these differences reached the point where the Papaguerian Hohokam were clearly distinct from the core area in that they (1) practiced inhumation burial; (2) used polished red-on-brown pottery, unsmudged redwares, and slab and basin metates; (3) had an abundance of crudely made stone tools but few specimens of projectile points, carved stone, palettes, figurines, and stone and shell jewelry; (4) subsisted primarily on the gathering of wild plants with only a few floodwater runoff-fed canals designed for agriculture; and (5) were not affected by the Salado after A.D. 1300. More recently Haury has dismissed the ties with the Archaic populations and has suggested that core area Hohokam colonizers settled in the Papagueria during the Colonial period (1976: 355; Weaver, Burton, and Laughlin 1978: 21-22).

Central to the Desert vs. River Branch dichotomy is the presence of permanent living streams in the Hohokam core area and the lack thereof in the Papagueria. Melding environmental and cultural determinism, the presence or absence of water for irrigation was the basis for the bifurcation of the Hohokam culture.

> To a point, the natural surroundings determined Hohokam behavior, but it was their attitude, will, and skills that decided the effective use of the habitat. . . . The key barrier to progress, a parched land, they solved from the start by taking the water from the river and putting it where it was needed (Haury 1976: 114).

The lack of water for irrigation in the Papagueria limited this regional population ". . . to a lower level of cultural attainment" (Haury and others 1950: 547) than was true for the core area Hohokam. Thus the Desert Branch Hohokam concept set the Papagueria apart from other regional populations both in terms of subsistence practices and material culture.

The evidence from Gu Achi and other pre-Classic period Hohokam sites in the Papagueria clearly indicates that most of the original material culture attributes of the Hohokam Desert Branch are no longer definitive. Of the list of traits named above only the scarcity of figurines and the more frequent use of non-trough type metates appear to be reliable indicators of differences between the Papagueria and the Hohokam core area, but even these two differences may be exaggerated because of the present small sample size of excavated Papagueria sites. The original traits suggested for the Desert Branch Hohokam are much more applicable to Classic period Sells populations than to pre-Classic period Hohokam. This fact serves to heighten the distinction between the pre-Classic and Classic period populations in the Papagueria.

The originally postulated difference in subsistence practices between the two regional branches of the Hohokam culture is also open for debate. Haury (Haury and others 1950: 545) stated,

> Agriculture, I believe, held strictly a third-rate position and certainly a late one in the combination of economics. Even the Papago depended on agriculture no more than on hunting and much less than on gathering. Among the Pima, cultivated foods provided 50 per cent to 60 per cent [Castetter and Bell 1942: 56-57] of the supply, made possible by irrigation waters from the Gila River And collecting overwhelmingly made up the balance. That a similar regional difference obtained for the Desert and River branches of the Hohokam of a thousand years ago is indicated.

The evidence from Gu Achi and the sites investigated by Raab (1974, 1976) and Yablon (1978) in the northern Santa Rosa Valley suggests that agriculture formed a very important part of at least the Santa Cruz/Sacaton phase subsistence strategies, a pattern that may have extended back to the Snaketown phase as well. While the present data base is not yet developed to the point where accurate percentages can be elicited, it appears likely that future work will demonstrate that agricultural products were as important (or nearly so) to the Papaguerian Hohokam as they were to core area populations. The Hohokam were not only masters at irrigation technology, but they were almost certainly experts at dry farming and floodwater runoff farming as well. The chances of environmental perturbations resulting in crop failure were most likely greater for the Papagueria than for the core area; nevertheless, in most years the subsistence economies of the two regions were probably quite similar.

The Desert Branch Hohokam concept as originally defined should no longer be used to refer to pre-Classic period Hohokam populations in the Papagueria. In terms of both material culture and subsistence the pre-Classic Papaguerian Hohokam are more closely tied to the core area than previously has been believed. Sites such as AA:5:30 and Gu Achi strongly suggest that Hohokam colonizers from the core area moved into the Papagueria around A.D. 500. Throughout the duration of their occupation (until about A.D. 1100), the fabric of Papaguerian Hohokam society remained closely intertwined with that of the core area.

However, at the same time there are differences between the two regional populations that should not be glossed over. A critical difference that seems to separate all other regional Hohokam populations from the Papagueria is the latter's lack of ball courts. This omission is even more puzzling since the construction of the smaller "Casa Grande"-style ball courts (of late Santa Cruz/Sacaton phase derivation) would have been no more difficult than the building of reservoirs such as the one at Gu Achi.

The general lack of figurines and the absence of "caches" (see Haury 1976: 175-190) in the Papagueria is also noteworthy. It is tempting to speculate that caches, figurines, and ball courts form some kind of a nonsecular package, and that their absence from the Papagueria indicates differences in social, political, or religious organization from other regional

Hohokam populations. Unfortunately, this hypothesis must remain tentative as little is known of the role of ball courts (see Ferdon 1967, Haury 1976: 78-79) or even figurines and caches in Hohokam society. Nevertheless, it seems likely that there is meaningful variability between the Hohokam core area and the Papagueria, but such variability may be more a non-economic phenomenon than a lifestyle determined by environmental conditions.

In concluding this critique of the Desert Branch Hohokam concept, reference is made to an insightful paper by Jennings (1973): "The Short Useful Life of a Simple Hypothesis." Jennings reviews the rise and apparent fall of the "Desert Culture" concept (originally formulated by himself) and writes (1973: 5),

> What, if any, are the broad conclusions one may draw from this review? One, by no means new, is that an idea, however brilliantly insightful it may be, is not valuable unless some one needs it or wishes to test it or apply it. In short, it is timely or it is nothing. Second, good ideas no matter how long neglected, often become "timely" and are either resurrected, or are frequently and honestly "independently" discovered. Third, in academic debate or speculation without data is sterile; with data in critical mass there is discovery, evolution, and refinement of hypotheses. In another vein all concepts in scholarship continuously evolve as new models or hypotheses are derived from new data and result in restriction or expansion, or other modification of some earlier, simpler concept.

The Desert Branch Hohokam concept has followed a path similar to that of the Desert Culture concept. The Desert Branch concept began as the simple observation that meaningful variability existed in contemporary prehistoric Hohokam populations, and the hypothesis that differences between the Papaguerian Hohokam and the core area Hohokam were largely the product of the presence or absence of permanent streams for irrigation. This hypothesis was interesting and timely in that the work of White (1943), Steward (1955) and others was beginning to demonstrate the importance of physical environment in cultural development.

However, as illustrated by Jennings, the introduction of new data, in this case the data from the 1970's contract projects in the Papagueria, makes it necessary to greatly modify the Desert Branch Hohokam concept. Variability *does* exist between the pre-Classic period Hohokam and those of the core area but the traits and subsistence patterns originally defined for the pre-Classic Desert Branch Hohokam are no longer valid. We should now simply refer to this population as the "Papaguerian Hohokam" and discard the term "Desert Branch" Hohokam because of the probable confusion caused by continued use of the term.

Likewise, the Sells phase populations should not be termed "Hohokam" in the sense that they apparently did not evolve directly from the pre-Classic period/Papaguerian Hohokam or core area Hohokam base. They more likely represent a development from amalgamated Mogollon/Hohokam-related populations in southeastern Arizona (as yet poorly defined) and Mogollon-related populations in Sonora. Because of this mixed ancestry, these Classic period populations should also not be termed "Desert Branch Hohokam", even though their material culture closely matches the original list of traits assigned to the Desert Branch Hohokam. This population utilized the pottery of the Sonoran Brownware Tradition and is here tentatively considered Mogollon/Sonoran(?) in cultural derivation. However, because of the uncertainties of the derivation of the Classic period populations in the Papagueria, perhaps for the present they should simply be referred to as the "Sells phase."

A Chronological Scenario for the Papagueria

To appreciate more fully the new level of synthesis that has been reached in this volume, some of the major points of the discussion are chronologically summarized below. The far right-hand column of Table 19 presents the temporal framework used in this volume and is compared with other previously defined chronologies for southern Arizona. It is emphasized that the temporal labels used in this table ("Initial Colonization," "Stabilization," "Efflorescence," "Retraction," and the Sells phase) are heuristic and are not intended to supplant the named phases and periods previously established at Snaketown (Haury 1976).

Late Archaic

Little information has been gathered concerning the nature of late

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PAGE

	Gila Basin Hohokam			Tucson Basin Hohokam	Papaguerian Hohokam				
	Haury 1976		Wilcox and Shenk 1977	Greenleaf 1975a	Haury 1950	Goodyear 1975	Rosenthal and others 1978	Masse this volume	
A.D. 1500									1500 A.D.
1400				Tucson					1400
1300	Classic Period	Civano	Civano		Sells	Sells		Mogollon/ Sonoran(?) Sells	1300
1200		Soho	Soho	Tanque Verde			Sells		1200
1100					Topawa	?		?	1100
1000	Seden-tary Period	Sacaton	Sacaton	Rincon		Middle		Retraction	1000
900					Vamori	Hohokam	Topawa	Efflorescence	900
800		Santa Cruz	Santa Cruz	Rillito		Period	Vamori		800
700	Colonial Period							Stabilization	700
600		Gila Butte	Gila Butte	Canada del Oro		Early			600
500			Snaketown			Hohokam		Initial Colonization	500
400		Snaketown	Sweetwater	Snaketown		Period	Amargosa I-II		400
300			Estrella						300
200		Sweetwater	Vahki	Sweetwater					200
100									100
B.C. 1	Pioneer Period	Estrella		?					1 B.C.
100									100
200		Vahki							200
300									300

Table 19. Hohokam chronologies.

Archaic population in the Papagueria. Our knowledge is limited to a few chipped stone tools found in the course of the Quijotoa Valley Project (Rosenthal and others 1978) and in other survey and testing programs and to substantial numbers of imperishable artifacts recovered from Ventana Cave (Haury and others 1950). The radiocarbon date from AZ Y:8:2 (Huckell 1978) would seem to place the end of the late Archaic a few centuries into the Christian era.

Two sites outside the Papagueria, the Pantano Site near Tucson (Hemmings and others 1968) and the Tumbleweed site in east-central Arizona (Martin and others 1962), provide us with our most reliable data concerning late Archaic settlement and subsistence. Both of these sites, which have been radiocarbon dated to between A.D. 100-300, contained evidence of agriculture (corn pollen). The Tumbleweed Site also had several pit house structures. This indicates that at least some Archaic populations were semi-sedentary agriculturalists. However, whether or not such a pattern occurred in the Papagueria can only be determined by future study. It may very well be that the aridity of the Papagueria limited subsistence and settlement to seasonal rounds of hunting and gathering.

Late Snaketown/Gila Butte Phase: The Initial Colonization Period

A discussion of the origins of the Hohokam culture is beyond the scope of the present volume. Whether we view the Hohokam as emigrants from Mexico or as a development from an indigenous Archaic culture base, the evidence strongly suggests that the Gila River Valley represents the cradle of this culture (Masse n.d.b). This initial development most likely falls within the period of A.D. 1-200 (Wilcox and Shenk 1977; Masse n.d.b).

The dating of the inital colonization of the Papagueria by the Hohokam, presumably from the Gila Valley, is based on sizeable sedentary occupations at two sites, Gu Achi and AA:5:30. Both sites exhibit tempurally diagnostic ceramic collections consisting primarily of buffwares transitional between Snaketown Red-on-buff and Gila Butte Red-on-buff, suggesting an approximate date of A.D. 500-600. Ceramic evidence from Ventana Cave indicates that brief forays may have been made by the Hohokam into the Papagueria before A.D. 500, but these were probably for hunting, shell gathering, or other non-sedentary purposes. The possibility that these early Hohokam ceramic specimens were trade pieces utilized by local Archaic groups also cannot be ruled out.

It may seem unreasonable to base the initial colonization of the Papagueria on the presence of just two sites only 15 miles from one another, but when viewed in terms of southern and central Arizona in general, it is clear that the Papagueria was part of a widespread phenomenon. During the period of A.D. 500-600 the Hohokam culture expanded into many regions, including the San Pedro Valley (Masse in press c), the Santa Cruz Valley, (Kelly 1978), the Agua Fria Valley (Huckell 1973), and several other areas. This same time period at Snaketown is characterized by an apparently substantial increase in population (Haury 1976: 77) and changing patterns of economic and/or social organization (Masse in press a; n.d.b).

Schroeder (1960) and DiPeso (1956) have recognized the major changes in Hohokam material culture that occur during this period, but they attribute these changes to the late entry of the Hohokam from Mexico and the imposition of a superior culture upon the indigenous Pioneer period populations. Present evidence does not support the Schroeder/DiPeso position (Haury 1976: 347, 352; Masse n.d.b); however, two important issues arise from the Schroeder/DiPeso argument--(1) the reasons for the changes during the late Snaketown/Gila Butte phase transition and (2) the nature of the interaction between the Hohokam and the indigenous populations in the areas into which the Hohokam expanded.

The first issue cannot be resolved satisfactorily as yet, but a few suggestions can be offered. The rapidity with which the Hohokam culture spread between A.D. 500-600 and their apparent increase in population indicate that a major agriculture advance(s) had taken place. The following two possibilities immediately suggest themselves: (1) the development of or refinement in irrigation and floodwater technology and (2) the introduction or development of strains of corn more suitable for floodwater and irrigation farming. Trade was probably important to the Hohokam, even at this early date. The material culture assemblages of the widespread Hohokam colonies show that close ties with the core area were maintained.

In the Papagueria, the sites of Gu Achi and AA:5:30 were clearly established in locations favorable for runoff agriculture, mesquite gathering, and dependable water supply for domestic purposes. Access to other resources, including the shell available in the Gulf of California, was probably of secondary concern. Of critical importance is the settlement pattern of this time period. Were Gu Achi and AA:5:30 permanent, year-round villages, or were they semi-permanent, seasonal farming settlements occupied only as long as water was available? If the latter situation was true, then where did the Gu Achi and AA:5:30 occupants move? Back to the Gila Valley? Or perhaps into the mountain flanks of the Papagueria? The presence of late Pioneer period villages in the western foothills of the Rincon Mountains and the northern foothills of the Sand Tank Mountains may indicate that a seasonally shifting settlement pattern was practiced. However, until more substantial evidence is gathered, it seems likely that Gu Achi, AA:5:30, and perhaps the foothills villages as well were occupied year round.

The second question raised by the Schroeder/DiPeso model of Hohokam culture history cannot be answered at present. Quite simply, there is little evidence of the interaction between the Hohokam and various regional indigenous populations. Haury was not able to perceive any noticeable break between late pre-ceramic cultural horizons and early ceramic period horizons in the cultural deposits at Ventana Cave. However, this does not explain the relationship between the two temporal/cultural horizons. This clearly remains a problem of great importance for all Hohokam regional areas.

Late Santa Cruz/Sacaton Phase: The Efflorescence Period

Between the end of the Inital Colonization Period (about A.D. 600) and the middle of the Santa Cruz phase (about A.D. 800-850), the Hohokam throughout southern Arizona seemed to experience slow steady growth and few changes in basic material culture. In the Papagueria sites that exhibit Gila Butte and early Santa Cruz phase ceramics nearly always had been first occupied during the Initial Colonization Period.

Late in the Santa Cruz phase, however, many changes took place in Hohokam culture. These included a dramatic increase in the number of sites outside the Hohokam core area, a concomitant rise in population at core area sites such as Snaketown, intensification of agricultural technology both in terms of irrigation systems (Haury 1976; Masse 1976) (and the mastery of dry farming techniques (Masse in press a, b, c)), the mass production of decorated pottery that may have existed at Snaketown (Haury 1976), and the development and proliferation of the use of Casa Grande-style ball courts in all Hohokam affiliated regions, with the exception of the Papagueria.

There is no question that substantial changes in Hohokam social and economic structure accompanied these manifestations. In the Gila Valley (Doyel in press) and the San Pedro Valley (Masse in press a) there is evidence to suggest that Hohokam populations had advanced to the point where they operated at a "chiefdom" level of sociopolitical complexity. However, the Papagueria does not appear to have shared a similar degree of complexity. Socially integrative features such as ball courts, platform mounds, and a figurine complex are lacking there. The absence of these items is undoubtedly important but is at present poorly understood.

Despite the lower level of sociopolitical complexity of the Papaguerian Hohokam, the ties with the core area were undoubtedly strong. Papaguerian ceramic assemblages during the Santa Cruz/Sacaton phase transition are nearly identical to those from the Gila Basin. Projectile points, shell, palettes, and most other items of material culture also show a close tie between the two regions. Intrusive ceramics at Gu Achi indicate that the site lies within the same general trading sphere as sites such as Snaketown. The abundance of marine shell in many Papaguerian sites, especially manufacture waste, suggests a role in shell trade for the Papaguerian Hohokam.

Agriculture was the primary subsistence pursuit for the Papaguerian Hohokam, as reflected by settlement location and by the identification of primary and supplementary agricultural fields. Crops such as corn, beans, squash, and cotton were successfully grown in these fields. Associated with the intensification of agriculture in the Papagueria was the construction of reservoirs at major village sites. Reservoirs insured the stability and year-round occupation of sites that were many miles from permanent sources of water.

This type of settlement system is best known from the northern Santa Rosa Valley (including Gu Achi) but has also been tentatively identified in Growler Valley at "Lost City" and at a site near Ajo recorded by Gila Pueblo.

In addition, a reservoir (AZ AA:3:2) has been found a few miles east of Florence (Emil W. Haury 1978: personal communication), thus possibly extending this pattern north of the Papagueria. It is noted, however, that the material culture associated with the reservoir may date to the Classic period (Arizona State Museum site survey files). The widespread distribution of these reservoir sites strongly suggests that many more such settlement systems will be located eventually in the non-riverine portions of southern Arizona.

An important topic for future research is the nature of the relationship between the Papaguerian Hohokam and the Gila River Valley. As far as we now know the relationship between the two regions was amicable. However, one possible explanation for the agricultural intensification seen throughout southern Arizona in the late Santa Cruz and Sacaton phases is that it was enforced. There is certainly no evidence that the pre-Classic Hohokam had any kind of a military organization. Perhaps some form of low level tribute system was in effect (for example, see Wilcox in press), although tribute is principally unidirectional.

Some time between A.D. 1000-1100, much of the Papagueria was abandoned by the Hohokam. This abandonment is well documented at sites such as Gu Achi and AA:5:43. Curiously, a similar pattern occurs in the San Pedro Valley, suggesting that this abandonment can be related to some widespread phenomenon (Masse in press c). The reasons for this phenomenon are unknown, but they are likely to be the same as those that led to the abandonment of Snaketown around A.D. 1100. I suspect that a combination of factors, including social unrest, climatic disruption of agricultural practices, the breakdown of Hohokam trade networks (Doyel 1977a; in press; Masse n.d.b) and perhaps even the initial stirrings of the powerful Medio Period culture at Casas Grandes (DiPeso 1974), all played a role in these substantial changes.

Sells Phase: The Mogollon/Sonoran(?) Tradition

For several reasons the Sells phase population of the Papagueria should be viewed as distinct from that of the pre-Classic period. First, there is a distinct hiatus between the two time periods at most sites. Major differences in ceramic assemblages, architecture, burial customs, and, seemingly, settlement patterns and subsistence practices sharpen the contrast between the two temporal/cultural periods.

It is admitted that somewhat parallel differences are present in the Hohokam core area between the pre-Classic and Classic periods. However, the core area exhibits considerable evidence for a smooth (but rapid) transition between the two periods. In contrast the Papagueria thus far produced no site demonstrably bridging the Sedentary and Classic periods. The single possible exception, Valshni Village, shows some evidence of a transitional Sedentary/Classic period occupation, but of only a short duration; it is notable that the occupation of Valshni Village did not extend far into the Sells phase.

While we cannot yet be certain, it seems likely that the Sells phase had its roots in Sonora (perhaps the Trincheras culture?) and in the Mogollon-related populations of southeastern Arizona, rather than with the pre-Classic period Hohokam of the Papagueria and the Gila Valley. This does not preclude the possibility that remnants of the pre-Classic period Papaguerian Hohokam were absorbed in the Mogollon/Sonoran(?) Classic period tradition between A.D. 1050-1150. The critical aspect of this time period is that there is currently little evidence to support the notion that the Sedentary/Classic period transition was a change in settlement and subsistence patterns in the Papagueria but not a change of people.

In terms of settlement and subsistence patterns, it is clear that substantial changes occurred between the Sedentary and Classic periods. In the Classic period there was a substantial shift in habitation site location from valley floors to upper bajadas though many habitation sites were still present in the valley floors. The sites noted in the Quijotoa Valley Project are an example of this shifting settlement. Concomitant with the change in settlement pattern was an apparent intensification of use of upper bajada and mountain resources as seen in the mountainous areas bordering the northern Santa Rosa Wash. Such activity may indicate a decreasing reliance on agricultural products and more dependence on wild plants and animals. However, the presence of numerous Sells phase agriculture camps at Gu Achi and many other locations in the Papagueria suggests that agriculture was still the dominant subsistence practice as it had been for the pre-Classic period Hohokam.

One of the least understood aspects of the Classic period in the Papagueria is the role played by Yuman-(Patayan-) related populations. The general absence of Yuman material in both the Papagueria (except the western Papagueria) and the Hohokam core area before A.D. 1100 contrasts directly to the proliferation of Yuman traits, especially in the Papagueria, during the Classic period. It is obvious that the Yuman culture is part of the confusing picture that surrounds the Sedentary to Classic period transition, but its role in these events has yet to be adequately delineated.

The Protohistoric Period

Without an intensive program of study, including excavation involving the earliest known Papago villages, the period between A.D. 1450-1700 will remain poorly understood at best. The present evidence does not adequately support either a "Hohokam-Piman" continuum or the lack thereof. An article by Ezell (1963) and a recent paper by Doelle (1979) have outlined the major issues involved in this debate.

Regarding the Papagueria, the question of an in situ "Hohokam"-Piman continuum is further complicated by the probability that the Sells phase populations are not "Hohokam." It is my belief, in agreement with Fontana (1976), that there was a general replacement of Papaguerian populations during the 15th and 16th centuries by Sonoran groups, in a manner similar to that hypothesized for the Sedentary/Classic period transition (Masse [illegible]). While such an argument is certainly reasonable, it is hard to shake the feeling that Sonora may have become a magic panacea for explaining away the unanswerable questions of Papaguerian culture history.

- - - - -

This concludes our scenario, a scenario built on some fact and much speculation. To state that there are significant gaps and weaknesses in this scenario is to point out what should be patently obvious. Fortunately, the rapidly accelerating pace of archeological work in the Papagueria, coupled with on-going projects in Sonora, will undoubtedly allow us to reach a new plateau of understanding in just a few years. It is hoped that the present volume will have provided a few directions and shortcuts along the way.

APPENDIX A

GU ACHI: SEEDS, SEASONS, AND ECOSYSTEMS

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INTRODUCTION

Gu Achi is a large Hohokam site of the late Pioneer-Sedentary period (c. A.D. 500-1100) located on the Papago Indian Reservation in south-central Arizona. The site includes such surface manifestations as deflated trash mounds and remnants of a prehistoric reservoir (Masse, this volume). The site is approximately 11 km (7 miles) southeast of Ventana Cave (Haury and others 1950) and about 30 km (19 miles) south of other Hohokam sites in the Papagueria that have recently been investigated by Goodyear (1975) and Raab (1975, 1976) in the Slate Mountains and nearby Santa Rosa Wash floodplain. An adjacent area in the creosote flats next to the latter sites has also been investigated by Yablon (1975). Impressionistically, this is a bleak, dry, and very hot area with little to offer humans. There are no permanent rivers. Closer inspection, however, reveals that this region is quite varied in available natural resources.

Gu Achi is located in a wide valley where the vegetation is dominated by creosotebush (_Larrea divaricata_). The remaining plant cover in this creosote plain consists of a few widely dispersed annuals such as _Plantago insularis_ and members of the Crucifereae family. The barrenness of the creosote plain is broken only where there are washes. Two major arroyos, Gu Achi Wash and Anegam Wash, traverse the plain, producing an important change in the vegetation in this valley. Anegam Wash lies only a few hundred meters north of the site of Gu Achi; Gu Achi Wash delineates the southern boundary of the site. Gu Achi Wash is lined with mesquite (*Prosopis juliflora* var. *velutina*), catclaw acacia (*Acacia greggii*), blue paloverde (*Cercidium floridum*), and desert broom (*Baccharis emoryi*). Other less frequently occurring species include whitethorn acacia (*Acacia constricta*), desert honeysuckle (*Anisacanthus thurberi*), cocklebur (*Xanthium* sp.), graythorn (*Condalia lycioides*), bursage (*Franseria deltoidea*), and crucifixion thorn (*Holacantha emoryi*). About 1.6 km (1 mile) south of the site is a mesic habitat dominated by mesquite. Immediately south of this mesquite area is a large community of saguaro (*Cereus giganteus* or *Carnegeia gigantea*) that extends to the upper bajada of the mountains about 3.2 km (2.0 miles) south of Gu Achi itself. Many mountains to the north and east have a relatively low density *Cercidium-Cereus* community growing on their slopes. There is, however, at least one other large dense stand of saguaro on the southeastern bajada of the Black Hills, less than 3.2 km (2.0 miles) northwest of Gu Achi. In sum, today Gu Achi lies between two major washes that are bordered by resource-rich riparian species, and dense stands of saguaro lie within a radius of 3.2 km to the north and south.

The first part of this study interprets subsistence activities at the local level, using flotation data from Gu Achi. Analogy to the Pima and Papago will be made to explain some of the uses of plant remains found at the site. At the local level I am especially concerned with knowing if archeobotanical remains can demonstrate sedentism in this region. The second part of the study employs a regional perspective and examines archeological subsistence and settlement procurement systems across major ecosystems that were utilized by the Hohokam.

GU ACHI FLOTATION DATA

I analyzed a data base of 29 flotation samples from Gu Achi in an attempt to document the prehistoric subsistence practices at this site. Seventeen of these samples yielded identifiable plant parts (Table 20), all of which are carbonized. Flotation data were also used to help identify one of the Gu Achi site functions, that is, whether it was a seasonal processing camp or permanent village.

Extrapolating from Pima and Papago ethnography, two major alternatives about site seasonality are suggested. It was considered possible that the site was either (1) a seasonal, special, limited-use camp or (2) a permanent village. Two local hypotheses were generated to aid in identifying this function of the site. These are stated below.

> Local Hypothesis I: Gu Achi was a seasonal, special-use camp.
>
> Test Implication: The flotation data should indicate seasonal clustering and homogeneity in recovered plant food remains.

For historic times Castetter and Underhill (1935: 13-14) and Russell (1908: 66) have documented that special limited-use camps were set up away from villages and were used for gathering the wild plant foods such as saguaro and mesquite. Such camps may have been occupied for as long as a month to exploit favorite resources. During times of prehistoric crop failure, one might expect that such camps might have been occupied for longer periods to gather two or more seasonally complementary wild plant harvests. A longer occupation of a month or two assumes an environment with two or more nearby available abundant resources (for example, saguaro and mesquite) growing relatively close to one another. Individual abundance of plant species and relative aggregation are thought to be criteria that aboriginals selected in choosing one area over another for exploitation (Gasser 1977c: 309-317).

The second hypothesis is directed toward the examination of site function, assuming a sedentary population.

> Local Hypothesis II: Gu Achi was a permanent village.
>
> Test Implication: Flotation data should indicate seasonal diversity as well as species diversity in recovered plant food remains.

Part of the floral diversity of a sedentary Hohokam site would include the remains of cultivated crops. In general, the practice of agriculture increases the sedentism of human populations. In addition,

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the floral remains from a sedentary Hohokam site should reflect plant harvests at different times of the year, not just during one season, as would be expected of special limited-use sites. Evidence of storage facilities, discussed later in this paper is also considered evidence of sedentism. These hypotheses will be tested against the seasonality and diversity reflected in the Gu Achi flotation samples.

A flotation sample can contain seeds and other plant parts that are indicators of the season in which they were harvested. Most wild plant species in the Sonoran Desert are only available for harvest during a limited part of the year. For instance, the popular saguaro fruit is only available for harvest in late June and July (Kearney and Peebles 1960: 569; Earle 1963: 54). Many cultivated crops are also seasonally restricted.

Gathering

The archeobotanical food record (Table 20) at Gu Achi contains a variety of wild plant foods that suggest gathering played an important role in the subsistence economy of the site's inhabitants. These wild plant foods are compared to similar finds at other Hohokam sites and to ethnographically known use by the historic Pima and Papago.

Several mesquite pods and one seed were found in a variety of loci at Gu Achi. It is very interesting to note that all of the retrieved mesquite pod fragments were immature; their seeds had not yet fully developed, and the pods were thus flatter than when mature. The determination of mature versus immature mesquite beans is admittedly partially subjective. However, I measured the thickness of five mature modern mesquite beans and 12 mature prehistoric mesquite beans from Pueblo Grande and compared them to measurements made on nine immature beans from Escalante Ruin. The modern beans measured from 3.60 mm to 5.85 mm in width while the prehistoric mature beans measured from 2.80 mm to 4.40 mm thick. The mean for the modern specimens was 3.45 mm. By comparison, the immature beans from Escalante ranged from 1.0 mm thick to 2.9 mm; their mean thickness was 2.01 mm. Thus, one might say that any mesquite bean less than 2.8 mm in thickness is immature. This indicates that the mesquite pods from Gu Achi (mean thickness: [illegible] mm) were picked green for consumption.

The harvesting of green mesquite beans has not been well documented for the Pima and Papago. Castetter and Underhill ([illegible]), however, state that the pod was at times eaten "fresh" by the Papago. As the Papago normally harvested dried pods, fresh, in this case, may refer to green pods. Other groups, such as the southern Paiute (Stuart [illegible]), are known to relish the green mesquite pods as a child would candy. Russell (1908: 74) mentions that "in primitive times" the Pima probably relied on mesquite as the most important article in their diet. Mesquite was commonly relied on as a food source by both the Pima and Papago (Castetter and Bell 1942: 60). With more extensive use in the past, it is quite possible that the protohistoric Pima took advantage of both immature and mature pod harvests. It is noteworthy that immature mesquite pods were retrieved from flotation samples from the Escalante Ruin Group on the Gila River (Gasser 1977b: 251). It is quite possible that immature pods have been found at other Hohokam sites but were not mentioned. Immature green mesquite pods are generally available in late June and July. The mature pod usually dries on the tree between July and September. Rates of maturity, of course, vary locally with topographic, edaphic and moisture conditions. There is no question that the Hohokam extensively utilized mature mesquite pods as food (Bohrer 1970; Gasser 1976; Doelle 1976: 53-68). In a synchronic survey of plant remains from 21 Hohokam sites, I (Gasser 1976: 37) found that 11 of those sites had remains of mesquite seeds or pods. As more research is done, this frequency will probably increase. Mesquite was found to be second only to corn (found in 15 of the 21 surveyed sites) in the Hohokam archeobotanical food record.

A small clump of fused and charred tansy-mustard (*Descurainia pinnata* or *Sophia pinnata*) seeds was found in Hearth 3 (sample 11). Both the Pima (Russell 1908: 77) and the Papago (Castetter and Underhill 1935: 24) utilized tansy-mustard seeds as a seed staple by parching and grinding them, then mixing the flour with water to form a *pinole* (Curtin

SAMPLE NO.	SOIL SAMPLE SIZE (LITERS)	PROVENIENCE*	CORN	COTTON	MESQUITE	PALOVERDE	CHOLLA	SAGUARO	MUSTARD	REED
		Excavation Area 1								
1, 3, 9	2.1	charcoal area	85 ml		21 p		60 b			
2	7.0	bell pit bottom	3 k							
6	0.5	Hearth 2					4 a			
8	2.0	inside Pot 6				2 s				
11	0.5	Hearth 3	3 k						100+s	
13, 26	0.5	near Pots 1 and 2								6 st
15	0.5	Hearth 4	1 k		2 p, 1 s					
16	0.2	inside Pot 3	91 ml				1 b			
21	0.4	Hearth 6		1 s			1 b			
25	1.0	charcoal area	10 k		3 p					
28	1.4	charcoal area	3 k		4 p					1 st
29	1.3	charcoal area	2 k							
		Excavation Area 2								
7	1.0	Hearth						1 s		
		Excavation Area 14								
24	6.0	charcoal area		2 s	4 p					
		TOTAL	180 ml	3 s	33 p 1 s	2 s	62 b 4 a	1 s	100+s	7 st

*see Figure 91 for location

ml = millimeters
15 ml = about 80 kernels

a = anthers
b = bud
k = kernel

p = pod fragment
s = seed
st = stem

Table 20. The Gu Achi raw flotation data.

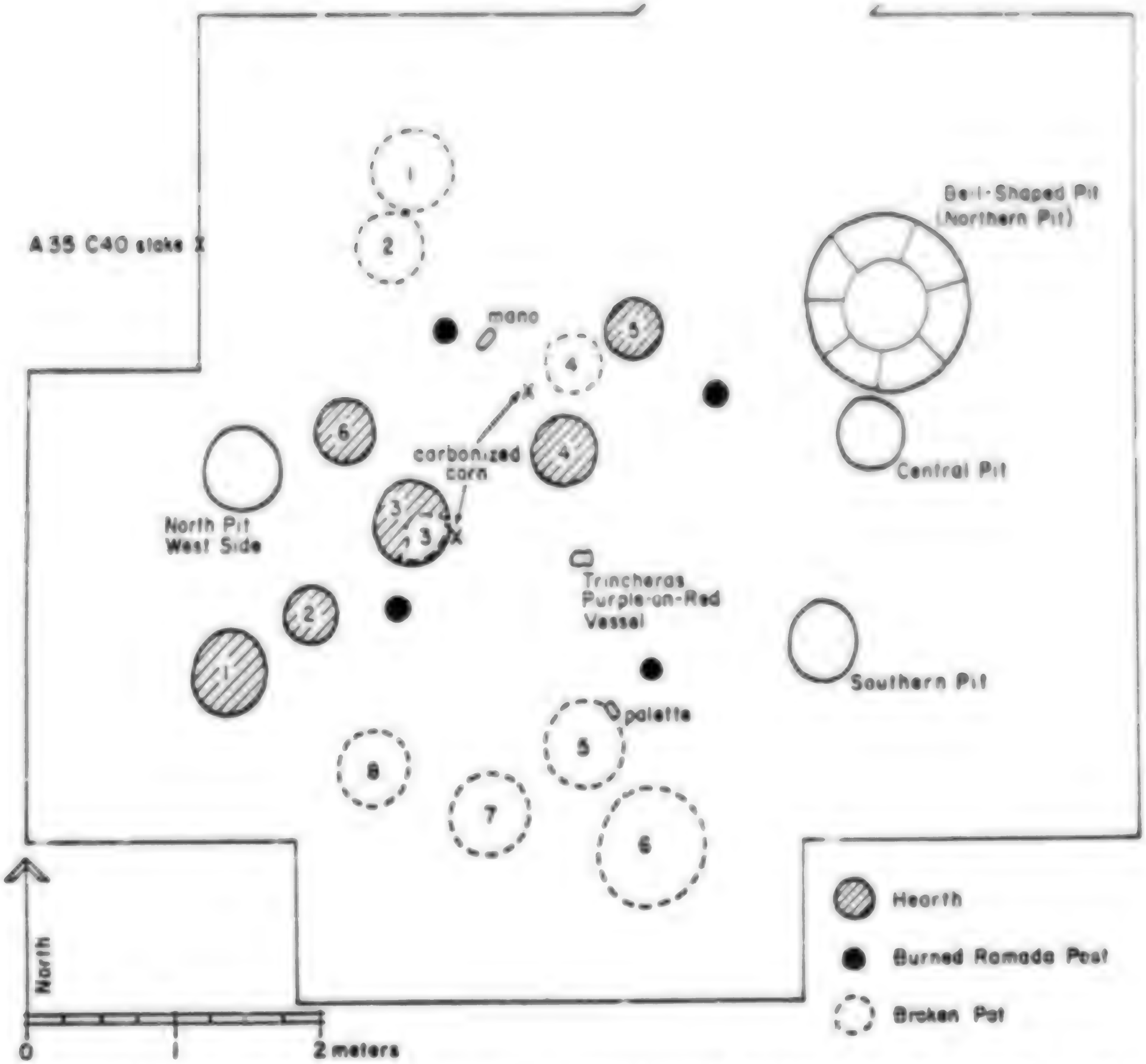


Figure 91. Map showing the location of flotation and pollen samples obtained from Excavation Area 1.

Fig. 392. Fragmentary charred remnants [illegible] mesquite pods from the [illegible] in Excavation Area 1. Length of specimen at upper right [illegible] mm.

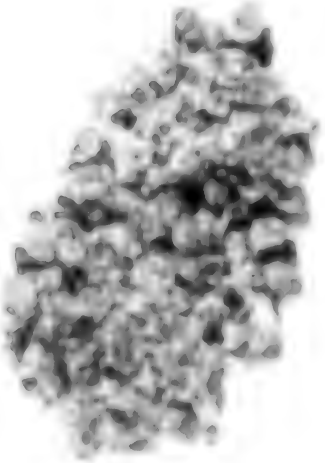


Fig. 393. [illegible] of charred tansy-mustard seed from Hearth 1 in Excavation Area 1. Length, [illegible] mm.

[illegible] 61). The Maricopa, Yuma, and Mohave utilized tansy-mustard seeds in a similar manner (Castetter and Bell 1951: 191). Caches of tansy-mustard seeds have been found at the archaeological sites AZ BB:13:41 (ASM) and AZ BB:13:50 (ASM) on the San Carlos Indian Reservation (Bohrer, Cutler, and Sauer 1969: 3) and at Snaketown (Bohrer 1970: 418). Tansy-mustard plants normally produce their seeds in September (Castetter and Underhill 1935: 23). This species, however, is a "shifter" (Bohrer 1970), that is, its germination and maturity are dependent upon the right combination of temperature and moisture. Thus, it may alter its seasonal growth pattern. This author has noticed tansy-mustard maturing in the late winter (February-March) in the Phoenix area.

Two paloverde (*Cercidium microphyllum*) seeds were found inside a restorable pot (Sample 8) at [illegible]. Both the Papago (Castetter and Underhill 1935: 23) and the Pima (Russell 1908: 75) used paloverde seeds in much the same manner as they used mesquite. Paloverde seeds were dried, parched, then ground into flour on a metate. The flour subsequently would be made into dried cakes or mixed with mesquite flour. Paloverde seeds have been found at the Hohokam sites of Ventana Cave (Haury and others 1950: 167) and Pueblo Grande (Bohrer 1970: 12-13). Paloverde beans are generally harvestable in July and August.

Remains of cholla buds were recovered from four different loci at [illegible] Ashi. Donald J. Pinkava, a botanist specializing in the genus *Opuntia*, has identified these buds as *Opuntia leptocaulis*, the Christmas Cholla. Four *Opuntia* anthers were found in sample 6 from fire pit number 2. These anthers are identical to anthers exposed in cross-sections of identified *O. leptocaulis* buds. This is the first reported evidence of utilization of this species. Cholla buds are considered a wild staple of the Pima and Papago (Castetter and Bell 1942: 60) though it was the larger species (*O. acanthocarpa*, *O. fulgida*) that were exploited. Cholla buds have been found at the Hohokam sites of Az BB:13:50 (ASM) near Punta del Agua (Bohrer, Cutler, and Sauer 1969: 5) and at Ventana Cave (Haury and others 1950: 164). High frequencies of *Cylindropuntia* pollen led Bohrer (1970: 116) and Schoenwetter (Gasser 1976: 53) to conclude that cholla buds were used as food at Snaketown on the Gila River and at Az U:9:1 (ASM) on the Salt River. Jennifer Gish (T. [illegible], personal communication) has recently found large quantities of *Cylindropuntia* pollen in many large "ovens" at [illegible] on the Salt River, which may indicate large-scale cholla bud roasting (perhaps for trade purposes). Gasser (1976a: 70) has found large amounts of cholla pollen in an unusual, unfired, stone-lined pit at Escalante Ruin [illegible]. The pollen evidence may be the result of cholla flower offerings; a ceremonial aspect is implied. Elsewhere at Escalante, Gasser (1976a: [illegible]) found evidence that cholla buds were used for food. Cholla buds normally occur on the plant during May and June (Kearney and Peebles 1960: 561).

A single saguaro seed was found in sample 7 at [illegible] Ashi. Both the Pima and Papago considered saguaro and mesquite, along with cholla buds and tansy mustard seed, to be their wild plant staples (Castetter and Bell 1942: 59, 60). The saguaro has received widespread ethnographic discussion because its fruits and seeds were made into syrup, wine, seed cakes

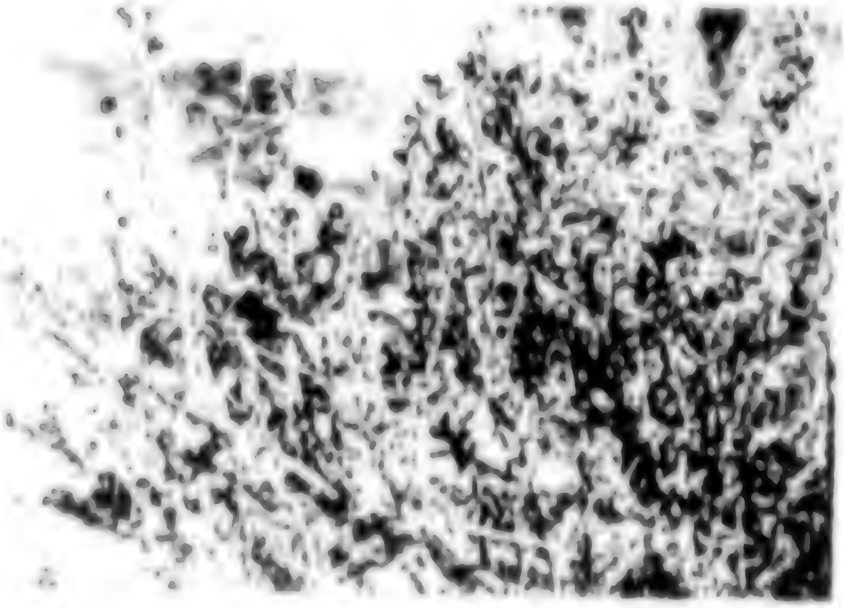


Fig. 94. Fruiting Christmas cholla observed near locus [illegible]

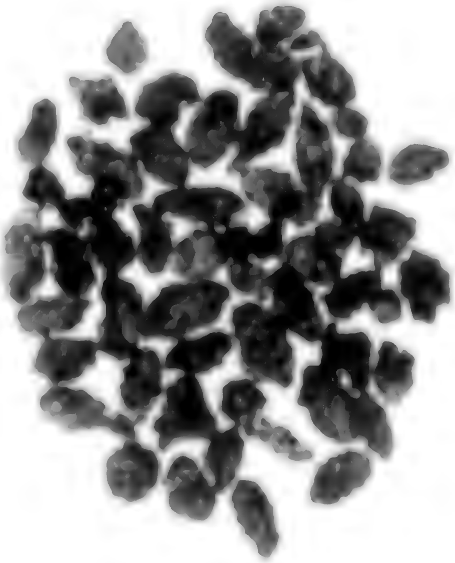


Fig. 95. Charred Christmas cholla buds from the [illegible] in Excavation Area I. Largest bud measures 1.7 cm.

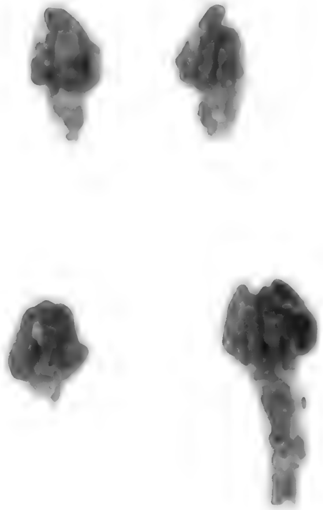


Fig. 96. Unusually well-preserved charred Christmas (?) cholla anthers from Hearth 1 in Excavation Area I. Specimen at lower right is 0.[illegible] cm in length.

or eaten as one would a fig (Bruhn 1971; Castetter and Bell 1937; [illegible] 1920). Saguaro seeds have been found archeologically at Snaketown (Bohrer 1970: 419), at Ventana Cave (Haury and others 1950: 166), and at Mesa Grande and Pueblo Grande (Gasser 1976: 22-25) in the Salt River Valley. Saguaro seeds have also been found at protohistoric Papago sites in the Slate Mountains of the Papagueria (Bruder 1977: 242). The saguaro fruit is only available for harvest in late June and July (Earle 1963: 54; Kearney and Peebles 1969: 569).

Three flotation samples (11, 26, 28) yielded identifiable remains of the common reed (*Phragmites communis*). I feel sure that reed remains were common at the site; however, they were too fragmented to be positively identified. It appears that *Phragmites* was used as fuel or kindling in fires, but it may also represent fallen light construction material. Reeds were common as light construction material at the Escalante Ruin Group on the Gila (Gasser 1977b). Russell (1908: 134) mentions that *Phragmites* was formerly common along the Gila River but has since disappeared completely. Teams of Russian hydrologists, botanists, and agronomists have examined the ecology of *Phragmites* and find that it can only grow where water is abundant. *Phragmites* does not grow in locales where the ground water table is lower than 5.0 m below present ground surface (Khudyakov 1965: 16; Shavyrina 1965: 19; Beideman 1965: 41). The presence of *Phragmites* suggests a local mesic habitat at Gu Achi. There is a prehistoric reservoir at Gu Achi (Masse, this volume; see Raab 1975, 1976: 75-91, 145) that probably contained stored water for a sufficient amount of time to provide a growing habitat for *Phragmites*.

Phragmites might be confused with corn stalks as both are similar in appearance. I distinguished the two on node characteristics. The nodes of *Phragmites* are inset; a smaller stem part fits into a larger stem with a clean edge at the juncture. Corn stalk nodes are irregular, bumpy, and not inset; sections of the corn stalk blend together at the node.

Agriculture

The Gu Achi flotation data (Table 20) indicate that agriculture played a vital role in the subsistence economy at this site. Corn (Zea mays) and cotton (Gossypium sp.) are the plant indicators of agriculture at Gu Achi. Beans (Phaseolus sp.) and squash (Cucurbita spp.) are noticeably absent.

The dispersal and frequency of corn at the site suggests that corn was a staple in the prehistoric diet that may have provided the extra edge needed to maintain sedentary populations in the Papagueria (see Conclusions). Only corn kernels were retrieved from the site. Lack of cobs and the fragmented nature of many of the kernels made identification as to race difficult. Therefore, no racial identification is attempted here. (See, however, Miksicek Appendix B.) Anderson and Cutler (1942: 71) have stated that there are as many problems in identifying the races of Zea mays and in recognizing them as there are in dealing with and identifying the races in mankind. Mangelsdorf (1974: 104) has noted that no less than 305 named races of corn have been known to grow in the western hemisphere (excluding the United States) in the past. Despite the fact that some races are "primitive" and some are "advanced," both primitive and advanced races may grow side by side in adjacent fields. Races are used by corn breeders primarily to combine desirable attributes from two or more varieties into one.

Corn is often documented as being the plant food staple of New World agriculturalists. The Hohokam are no exception (see Bohrer 1970; Gasser 1976). The presence of corn is assumed in riverine environments where canals were employed for field irrigation (Haury 1976: 120-151; Masse 1976: 1-46; Doyel 1974: 10-14; 1977a: 99-102); however, its common presence and importance has not been well documented for the Hohokam in desert regions away from major river courses. In the Papagueria corn has been found at Ventana Cave (Haury and others 1950: 161-165; Miksicek, this volume); and at the sites of AZ AA:5:14 (ASU) and AZ AA:5:21 (ASU) between Vaivo Vo and Kohatk (Table 22). Corn pollen has been found at site AZ AA:15:43(ASM) (Raab 1976: 32) in the Santa Rosa Wash and at a Sells phase site, AZ Z:14:33 (ASM) in the Quijotoa Valley (Westfenden 1978).

Three cotton seeds were retrieved from two different proveniences at Gu Achi. Cotton seeds have been known to have been parched and eaten by both the Pima and Papago (Castetter and Bell 1942: 198); the plant was also used for its obvious fiber value. Cotton has been found in the Hohokam sites of Ventana Cave (Haury and other 1950: 167-168), La Ciudad, Pueblo Grande, AZ U:10:7 (PGM), (Gasser 1976: 22-23), Las Colinas (Gasser n.d.a), Casa de Loma (Gasser n.d.a), and Snaketown (Bohrer 1970: 422; Castetter and Bell 1942: 52-53). Cotton has also been found at the Escalante Ruin Group (Hall 1974: 201). Recent analysis of 31 flotation samples from Escalante (Gasser 1977b: 253-256) suggests that cotton was being grown (as a crop) for trade by the riverine Hohokam.

Cotton seeds require a soil temperature of about 65° F in order to germinate and mature (Dennis and Briggs 1969: 4). Apparently, high cotton yield can be obtained only with proper irrigation (Tillman 1958: 210). The Hopi raise a variety of cotton that has the shortest growing season on record, producing ripened bolls within 84-100 days after planting (Jones 1936: 51-57; Lewton 1912: 9-10; Kent 1957: 466-468). Castetter and Bell (1942: 182-187) state that the Pima did not harvest their cotton until late October and early November, when their other crops were already taken care of. The Maricopa, on the other hand, tended to harvest their cotton from mid-July through August (Spier 1933: 58-61). These data imply that cotton grown by the Hohokam may have been harvested between mid-July and November.

It should be pointed out that the presence of cotton at Gu Achi may not be the result of local cultivation. One must consider the possibility that cotton was traded into the Papagueria from other Hohokam sites on the Gila River where its growth and productivity would have been enhanced by extensive canal irrigation systems.

The location of most of the Gu Achi flotation samples that yielded plant remains is shown in Figure 95. It is clear that most of the samples are associated with a probable ramada structure, which is further associated with broken pots, charcoal-filled hearths, shallow pits, and a large

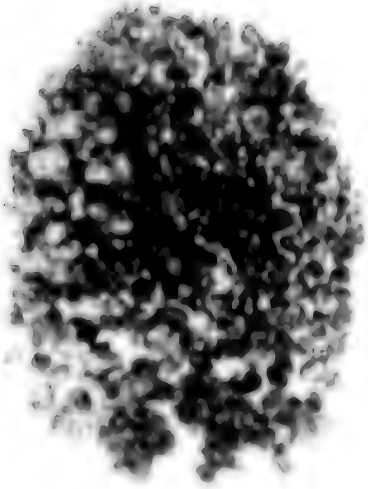


Fig. 37. Charred mass of corn kernels from the ramada in Excavation Area 1.

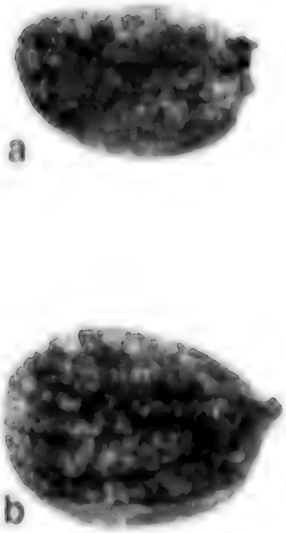


Fig. 38. Charred cotton seeds: (a) is from Hearth 6 in Excavation Area 1, (b) is from Excavation Area 14. Length of b is 0.75 cm.

bell-shaped pit (56 cm in diameter at the top, 112 cm in diameter at the bottom, and 68 cm deep). The hearths range from 30-48 cm in diameter and from 5-14 cm in depth. No fire-cracked stone was found in the hearths, which seemingly precludes a roasting pit function. The shallow pits show no evidence of burning, and their depth (13-24 cm) suggests that they were abandoned pot rests (Haase, this volume). Flotation samples were taken from most of the features in this structure; however, not all of the samples yielded plant remains. The frequency of hearths in this area suggests that the general locus was used repeatedly and, at times, discontinuously, over a long period of site occupancy. This fact is partially substantiated by the C^{14} dates obtained from Excavation Area 1 (Haase, this volume). It is clear from the archeobotanical record that this ramada functioned for the preparation, storage, and consumption of a variety of foods, including corn, mesquite and paloverde beans, cholla buds, and cotton and mustard seeds.

Information from Pollen Data

Pollen data from Gu Achi (McLaughlin Appendix C this volume) may be used to make inferences about local use of plant parts retrieved as a result of flotation analysis. It should be noted that I am not a specialist in palynology, but the seemingly complementary nature of the pollen data and the flotation analysis encouraged the brief discussion that is presented here.

The archeological Cheno-Am values are consistently 4 to 5 times greater than the modern surface values (15 percent at surface compared to 63-84 percent in the prehistoric samples). McLaughlin suggests that the high prehistoric Cheno-Am values are probably due to disturbance at the site. Schoenwetter and Doerschlag (1971) would interpret the depressed Cheno-Am and high Compositae and Gramineae values from the surface sample as an indication of modern increased xericity when compared to the high Cheno-Am and low Gramineae values of the prehistoric samples, which are thought to reflect a moderately mesic environment (Schoenwetter 1977: personal communication). In addition, it seems likely that if agriculture were practiced near Gu Achi, then watered and disturbed fields would support high Cheno-Am producers. It thus seems plausible to offer nearby agricultural fields as one viable explanation for the high Cheno-Am values found in the prehistoric samples.

Pollen grains comparable to *Zea* were found on the occupation surface of Excavation Area 1. Charred corn kernels were found in some abundance in this same area. It is possible that the *Zea* pollen adhered to the corn caryopsis during preparation and that what we have preserved today is the result of localized preparation and fair evidence for local cultivation of corn. *Zea* kernels and probable *Zea* pollen grains were also found together in the large bell-shaped storage pit. The storage aspect lends support to the hypothesis that Gu Achi represents a permanent sedentary village.

The interior of the storage jar (pot #6) on the south end of the excavation produced pollen (sample 4) and flotation (sample 8) data that suggest that perhaps cotton and little-leaf paloverde seeds were once stored in this vessel. The Leguminosae pollen may have adhered to the paloverde seeds up to the time of being stored in the vessel. An identifiable Cercidium pollen grain (pollen sample 1) was found on the nearby occupation surface. The presence of a possible Gossypium pollen grain complements the occurrence of the seed in the fire pit about 3.5 m away.

Additional pollen data that is complementary to this flotation analysis is the presence of both Cruciferae seeds and pollen and cholla buds and Opuntia pollen. These data suggest that low "economic" pollen values in an archeological context seemingly are indicators of plant foods used at the site. Palynologists frequently hesitate to imply economic use of plants when pollen values are below 5 or 10 percent. On the basis of independent macrofossil data, I suggest that some pollen values in the 0.5-3.0 percent range may be significant as indicators of plant use at the site. The complementary data (palynological and flotation) for Zea, Gossypium, Opuntia, and Cruciferae, seem to warrant speculation that Agave (pollen sample 1) was also used at the site. Unidentified, fragmented monocot tissues were encountered during flotation analysis; however, these remains may be attributable to Phragmites or Zea rather than Agave.

CONCLUSIONS ABOUT LOCAL DATA: SEASONALITY

The conclusions in this section are directed toward identifying the seasonal longevity of the Gu Achi site occupation and toward a better understanding of Hohokam subsistence adaptation in the desert environment of the Papagueria. This will be accomplished first by a synthesis of the seasonality of the prehistoric plant remains from Gu Achi and then by a synthesis of all reported plant food remains from Hohokam sites in the Papagueria.

The seasonality implication of the Gu Achi archeobotanical food remains is summarized in Table 21. It is apparent that plant harvests took place at least between May and September. The Gu Achi flotation analysis does not indicate the exploitation of greens from winter annuals, berries, or cool season grasses (see Bohrer 1975b). Use of such perishables would complete the annual cycle of available resources. The plant species recovered from Snaketown (Bohrer 1970), a permanent village on the Gila, cluster seasonally between spring and late fall. I found the same to be true with the Tonto National Monument remains (Bohrer 1962). Apparently we do not find plant remains from winter harvests in many permanent sites. Bohrer (1972: 28) adds that the pollen spectrum is of little use in determining winter occupancy.

The diversity in seasonality and in species recovered from the site fulfill the expectation of Local Hypothesis II of this research. The archeobotanical data (Table 20) indicate that Gu Achi was not a seasonal special limited-use site but rather a sedentary or, at least, semi-sedentary village and suggest that the Hohokam had sedentary or semi-sedentary villages in the Papagueria and a plant diet similar to that of riverine Hohokam groups (see Bohrer 1970; Gasser 1976, 1977b).

From an opposing point of view, one could argue that Gu Achi was a seasonal base camp, provided one assumes that the cotton seeds were traded in and that the tansy-mustard seeds represent stored foodstuffs brought to the site by migrating peoples. If these two plants are excluded, the data cluster seasonally between May and August. Hence a seasonal camp could be indicated. The latter suggestion, however, ignores (1) the need for Gu Achi to be occupied at planting time in the early spring and thereafter to tend the fields, (2) "negative evidence" in the form of edible greens,

PLANTS FOUND	SEASON AVAILABLE
CULTIVATED	
corn	June-July, October-November
cotton seeds	July-November
GATHERED	
mesquite pods and seeds	June-July (green), July-August (mature)
paloverde seeds	July-August
Christmas cholla buds	May-June
saguaro seeds	June-July
tansy-mustard seeds	September, February-March (variable)

Table 21. Seasonality of the Gu Achi plant food remains.

berries, and tubers that would normally not be preserved, (3) the fact that stored foods are indicative of a sedentary group, (4) the substantial artifactual and inferred architectural assemblage at Gu Achi, (5) the fact that all restorable jars in the excavation area are storage vessels in excess of 70 cm in diameter (Masse, this volume), and (6) the motivation for building a reservoir at a site that was only occupied seasonally. The Papago built small earthen dams to trap water for seasonal use (Castetter and Bell 1942 42-45); however, these do not compare to the deep Hohokam reservoir at Santa Rosa (Raab 1975), which is similar, in surface manifestations, to the one at Gu Achi. Based on the above, it is my opinion that Gu Achi was occupied year round. This does not preclude small task groups leaving Gu Achi for short periods of time to hunt and gather in other regions.

Gu Achi is not an isolated entity in the Papagueria. The analysis which follows puts the Gu Achi data into a regional perspective.

REGIONAL ANALYSIS

Recently Eugene Odum (1977: 1289) has stated that "we are abysmally ignorant of the ecosystems of which we are dependent parts." This section of the study is oriented toward the ecosystem level and attempts to understand the Hohokam of the Papagueria in relation to the diversified ecosystems within the region. The topography and biogeography of the Papagueria might grossly be divided into three distinct major ecosystems: (1) uplifted mountains with a Cercidium-Cereus plant community growing on the upper bajadas, (2) wash floodplains with a Prosopis-Acacia border, and (3) flat plains dominated today by Larrea (creosotebush). The holistic approach of Odum (1977) and Butzer (1975) is taken, and man is seen as an organism in relation to the three ecosystems. The theoretical orientations taken here are also influenced by Jeter's (1977) regional subsistence analysis in west-central Arizona.

The first regional paleoethnobotanical hypothesis generated for this research suggests that the region as a whole is necessary for a functioning subsistence system (see Goodyear 1975: 246-253).

> *Regional Hypothesis I*: No single ecosystem is sufficient in and of itself to support permanent sedentary villages in the Papagueria.
>
> *Test Implications*: Plant food remains from habitation loci should contain species from ecosystems other than the one in which they are located, indicating "support" from the other ecosystems.

This hypothesis, and others to follow, is tested by an examination of resource diversity, abundance, seasonality, and dependability in the individual ecosystems. An important additional test is an examination of variability in archeobotanical food data from Hohokam sites in the area (Table 20). Site activity loci and settlement patterns are used as aids in developing a regional perspective.

The available data come mainly from three adjacent ecosystems about 30 km north of Gu Achi that have recently been investigated by both archeological survey and excavation (Goodyear 1975; Raab 1976; Yablon 1978) for the purpose of examining site settlement and subsistence patterns within each ecosystem. A relation of the three ecosystems to one functioning system will be attempted. As supportive evidence the Ventana Cave (Haury and others 1950: 160-169) and Gu Achi archeobotanical food remains will be compared to the three adjacent ecosystems listed above.

Much of the remainder of this report deals with a large chunk of desert landscape that contains the variety of ecosystems to be found in this region of southern Arizona. This landscape runs from the Slate Mountains in the east, with an abundant food-producing *Cercidium*-*Cereus* complex on the slopes (Goodyear 1975), west to the Santa Rosa Wash floodplain, which is dominated by a *Prosopis*-*Acacia* riparian habitat (Raab 1976), and further west to a *Larrea* plain that is cut by small washes (Yablon 1978). These adjacent study areas, which span a width of about 15 km, provide a unique opportunity to examine subsistence and settlement patterns in relation to one diverse environment.

It must be cautioned that many of the datable sites found in the Slate Mountains and on the Santa Rosa Wash floodplain are attributable to the Sells phase, which is younger than the Gu Achi remains. Likewise, the materials from Ventana Cave probably include both pre-Classic and

Classic period specimens. The working assumption is that some Hohokam subsistence strategies are the same regardless of chronological ordering. Masse (1977: personal communication) has aptly cautioned, however, that the Sells phase people of around A.D. 1200 may not be "Hohokam" as they are distinct as a population from the riverine Hohokam of the same period. Thus, this synchronic working hypothesis must remain tentative until chronological controls and our knowledge of archeobotanical remains are refined for the Papagueria. Masse believes that we will most likely find differences in subsistence practices between the Pioneer/Colonial period transition, the Colonial/Sedentary period transition, and the Sells phase people. I will pursue my own position while recognizing an alternative.

Regional hypothesis II is specific to the *Cercidium*-*Cereus* communities on the upper bajadas of mountains in the Papagueria.

> *Regional Hypothesis II*: The *Cercidium*-*Cereus* community food resources on the upper bajadas are seasonally restricted and could not offer sustenance to support year-round habitation there.
>
> *Test Implication 1*: Available resources should cluster seasonally and might have associated gathering and processing loci.
>
> *Test Implication 2*: Substantial habitation loci should not be located on the upper bajadas.

Quantified data on vegetation and site types gathered by Goodyear (1975) demonstrate that the upper bajadas of the Slate Mountains contain copious amounts of several key desert food plants that grow in aggregated stands. The Slate Mountains thus provide an ideal locale to be exploited by groups gathering wild plants. The plant species growing on these slopes are xeric; one of the adaptive mechanisms of these plants is that many of them tend to fruit even during dry years as a survival response. Thus, except perhaps during long and severe drought, these plants provide a dependable wild food source for humans. Another advantage is that the fruits are a good source of vitamins A and C, which otherwise might be lacking from the diet. Goodyear has found convincing evidence in the Slate Mountains for extensive wild plant exploitation by the Hohokam. He identifies a variety of limited activity sites that probably functioned separately for harvesting cholla bud, saguaro, and organ-pipe cactus (*Lemaireocereus thurberi*) fruit and seed, prickly-pear (*Opuntia phaeacantha*) fruit, and leguminous seeds (Goodyear 1975: 55-107). Goodyear's data imply that individual task groups seasonally went to the individual plant stands to gather food. During the seasons (May-Jul.) that these foods are available the Slate Mountains could sustain small groups entirely or supplement the diet of larger groups. The only problem with the wild plant foods in the *Cercidium-Cereus* community is their short seasonal availability. As a sole food source these foods probably would not support a sedentary population.

Goodyear did not find any evidence of habitation structures in his research area; these are to be found on the floodplain of the nearby Santa Rosa Wash. The data from Goodyear's study substantiate Regional Hypothesis II. The upper bajadas contain (1) seasonally restricted wild plant foods, (2) gathering and processing loci on their slopes, and (3) no habitation structures.

Raab (1975, 1976) investigated a series of large Sedentary period and Sells phase Hohokam rancheria settlements on the Santa Rosa Wash floodplain that included the remains of at least two prehistoric reservoirs. These sites are approximately 8.0 km (5.0 miles) north-northeast of Goodyear's project area. A mesquite bosque is near these sites and the land upon which sites are located represents some of the best arable land in the area.

Regional Hypotheses III and IV were generated specifically for wash floodplain sites in the Papagueria.

> *Regional Hypothesis III*: The wash floodplain sites have insufficient resources available to support a human population within only this ecosystem.
>
> *Test Implication*: Plant food remains from other ecosystems should be common in floodplain sites.
>
> *Regional Hypothesis IV*: The wash floodplain sites have sufficient resources within its ecosystem to support sedentary populations.
>
> *Test Implication 1*: Wild riparian species and domesticates should be found in habitation and

trash loci in such frequencies in relation to species from other ecosystems to indicate that the latter are incidental to the diet.

Test Implication 2: Wash floodplains should contain archeological evidence of villages.

The Gu Achi archeobotanical data (Tables 20, 21) and eight flotation samples from Raab's site AZ AA:5:43 (ASM) (Gasser 1976: 24) are used to test the botanical aspects of the above hypotheses. Expectations were that the Santa Rosa Wash samples would yield a variety of plant remains such as that found at Gu Achi. The limited amount of analyzed samples from the Santa Rosa Wash site, however, yielded nothing but mesquite seeds from both trash and hearth contexts. The mesquite was undoubtedly gathered from the adjacent bosque. It is probable that the Santa Rosa Wash inhabitants utilized the Slate Mountains (some 3.5 km distant) for cacti procurement, as did the Gu Achi people, even though this is not indicated by the archeobotanical data from this site. As it now appears, Santa Rosa might be classified as a limited-use site. The lack of cacti and other plant data at Santa Rosa is probably due to the insufficient number of processed flotation samples and to the fact that trash deposits may not adequately represent the diversity of plant foods used by a Hohokam village (Gasser n.d.c). Raab (1976: 32) did find corn pollen at his site. These data imply that the floodplain was used for both habitation and agricultural purposes.

The Santa Rosa Wash and Gu Achi floodplains have at least two valuable resources that were exploited by the Hohokam. The first is a dense aggregation of mesquite trees. This Prosopis-Acacia ecosystem has seasonal constraints, however, in that its food resources are normally only available in July and August. The second resource is the arable land that covers the floodplain. Raab's data demonstrated that corn was probably grown here, and crops might have provided sustenance sufficient to support a village. Dry farming in the Papagueria is at the mercy of less than dependable rainfall patterns. Lack of rains, or late rains, make farming near desert washes difficult at best. Bohrer (1970) has indicated that even the riverine Hohokam had problems with their crops. The mesquite seeds at Santa Rosa might be interpreted as indicators of local crop failure as they are at Snaketown (Bohrer 1970: 424). Thus undependable crop yields seems to have been a problem with dry farming in southern Arizona. The Prosopis-Acacia ecosystem might adequately support sedentary populations some seasons (or even years), but it could not be relied on entirely for subsistence needs from year to year and decade to decade.

Regional Hypothesis III is not supported by the ethnobotanical data from the Santa Rosa Wash site. It is, however, supported by the Gu Achi data, which suggest that resources outside of the floodplain ecosystem were important elements in the diet of these agricultural people. This hypothesis must remain tentative until additional excavation and subsequent analysis are completed at Gu Achi or other sites on the floodplain.

Regional Hypothesis IV is supported by the fact that both Masse and Raab demonstrate that their sites are indeed villages. The data from Gu Achi and Santa Rosa, however, are insufficient to validate Test Implication 1 of this hypothesis. This hypothesis needs to be tested with a wide variety of cultural loci at each floodplain site. I feel that such data, if available, would generally support the hypothesis but would also indicate periods when resources from other ecosystems were critical to maintaining permanent villages on the floodplain.

The last major ecosystem to be considered is a creosote plain that is due west and adjacent to Raab's (1976) project area. This area has recently been investigated archeologically first by field survey (Brown 1976) and later by additional survey and excavation (Yablon 1977, 1978). Yablon and Brown refer to this area as the Vaiva Vo/Kohatk Road Project.

This site area lies on a plain dominated by creosote and is at least 5.6 km (3.5 miles) from the nearest cacti resources. It is important to keep in mind that the creosote plain may have been covered with grasses, to the near exclusion of shrubs, less than 100 years ago. This dramatic change has been brought about in many areas of the Southwest by the overgrazing of cattle by Anglos in the A.D. 1880-1900 period (see Brown 1950; Gardner 1950, 1951; Wagoner 1952; Humphrey 1958, 1974; Hastings and Turner 1965). Masse (this volume) states that a 1929 photograph of Gu Achi taken by Midvale (Fig. 5) indicates stability of the immediate site environs since that time.

My research on the historical ecology of desert grasslands indicates that a significant amount of irreversible damage was already done by 1930 (Gasser n.d.b; Gasser and Jeter 1978).

The creosote plain is cut by a number of washes, running west-east, that have mesquite, blue paloverde, and large cat-claw acacia shrubs bordering their courses. The Vaiva Vo/Kohatk Road Project area contains a number of Hohokam sites. Most of these sites are just sherd and lithic scatters; however, a few sites were identified by Yablon (1978) as isolated habitation loci dating to the Sedentary period (A.D. 900-1150).

Two sets of regional hypotheses were developed for the creosote ecosystem. The first is similar to the local hypotheses presented earlier and will be concerned with the seasonality of the Vaiva Vo/Kohatk habitations sites. The second is concerned with identifying the function of these sites.

> Regional Hypothesis V: The creosote plain was occupied seasonally.
>
> Test Implication: Plant remains from sites on the creosote plain should cluster seasonally.
>
> Regional Hypothesis VI: Habitation sites in the creosote plain represent supplementary agricultural field house loci.
>
> Test Implication: Habitation sites in the creosote plain should contain the remains of cultigens in addition to seasonally complementary gathered resources.

Fourteen flotation samples from four sites excavated by Yablon (1978) were analyzed. Seven of these samples yielded identifiable plant remains (Table 22). These archeobotanical data are used to check the test implications for Regional Hypotheses V and VI. Only one site (AZ AA:5:14 (ASU)) could be documented as a habitation structure; the remaining three were apparently isolated hearths. The flotation analysis produced corn kernels, mesquite seeds and mature pod fragments, saguaro seeds, Gramineae grains, seeds of wild gourds (*Cucurbita digitata*), and purslane (*Portulaca* sp.). Wild gourds grow today in some of the nearby washes and appear as foods in other Hohokam sites (see Gasser 1976). Purslane is a succulent-leafed annual belonging to the Carpet-weed family that is beginning to be recognized

	Gu Achi	Ventana Cave	Slate Mountains	Santa Rosa Wash	Vaiva Vo/[illegible]	EDIBLE ORGAN
CULTIGENS						
corn	+	+	-	+	*	grains
squash	-	+	-	+	-	flowers, fruits, seeds
cotton	+	+	-	+		seeds
WILD SPECIES						
mesquite	+	+	+	+	*	fruits, seeds
paloverde	+	+	+	-	*	seeds
ironwood	-	+	-	+	-	seeds
saguaro	+	+	+	-	*	fruits, seeds
cholla	+	+	+	-	-	buds, stems
prickly-pear	-	+	+	-	*	fruits, stems
wild gourd	-	-	-	-	*	seeds
purslane	-	-	+	-	*	leaves, seeds
grass	-	+	-	-	*	grains

* indirect evidence based on specialized limited activity loci (Goodyear 1975: 26-197)

Table 22. Comparative analysis of exploited plants from Hohokam sites in the Papagueria.

as an important prehistoric foodstuff (see Bohrer 1970: 425; Gasser n.d.c, 1977a: 166; Adams 1977: 9). Varieties of introduced purslane are weedy in that they invade disturbed ground, including agricultural fields. It is possible that some native species also exhibit this weedy character.

The Gramineae grains warrant separate discussion. Only two grains were found; they were charred (as were all of the other seeds mentioned above), indicating prehistoric utilization. It is not known if these grass grains represent cool season or warm season grasses (see Bohrer 1975b) since grains could not be identified below the family level. However, these seeds might be significant for their environmental implications if these remains reflect utilization of an abundant resource (grasses) that is virtually absent today from the immediate area. The reader must judge the possible ramifications of substituting a grassland ecosystem for the creosote plain ecosystem in the above regional hypotheses.

The Papago used Sacaton grass (*Sporobolus wrightii*) seeds as a dietary supplement (Castetter and Underhill 1935: 24). The Papago data suggest that the grasses around the villages that ripened in September and October were those that were collected. Russell (1908: 66-92) does not mention Pima utilization of grass seeds. For the historic past, Castetter and Bell (1942: 41) quote Caborca's account of the Papago given in 1764, "Papagos is the name given by the Pimas to those particular Pimans who live in the desert as far as Tucson and . . . up to the Gila, living on seeds, grass, rabbits, rats and wild fruits." Caborca's observations suggest a long history of grass exploitation by the desert-dwelling Papago.

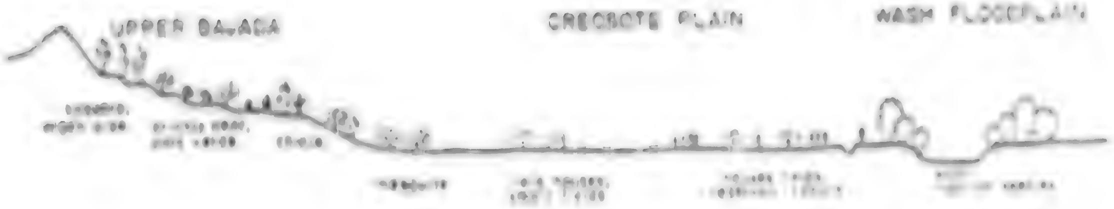
Archeologically, Bohrer (1970: 415) found at least two types of grass seeds in trash deposits at Snaketown. These seeds were identified as little barley grass (*Hordeum pusillum*) and probable *Panicum fasciculatum* seeds. Haury (Haury and others 1950: 167) also noted grass grains at Ventana Cave.

Regional Hypothesis V assumes that the Vaiva Vo/Kohatk sites were occupied seasonally. Does the available data indicate this to be true? Table 21 indicates that corn might be available in late summer and/or late fall. Mesquite is normally ready for harvest in late summer and saguaro in early summer. Grass grain identification is not accurate enough to determine seasonality. Wild gourds would be available in the summer, and purslane matures in the fall. These data tentatively indicate that the Vaiva Vo/Kohatk sites were occupied during the summer and fall and tend to substantiate Regional Hypothesis V.

Yablon (1978) and I assume that some of the Vaiva Vo/Kohatk sites functioned as supplementary agricultural field houses (Regional Hypothesis VI). The presence of corn, and of the agricultural weed *Portulaca*, seems to substantiate this assumption. We also find that the seasonality of gathered resources complements the agricultural season when the field houses were occupied. But why are supplemental field houses necessary? Some fields on the major wash floodplains may have failed to produce expected yields or any harvest at all. The Hohokam could have established small supplementary fields scattered among different microhabitats in the hope that some fields would produce when others failed. These supplementary fields would be found on alluvial fans at the base of mountains and along washes in the creosote plain (Rodgers 1974: 40-43). The home bases for these seasonal field house occupants were probably the large sites on the Santa Rosa Wash floodplain. Yablon (1978) considered these sites to be summer field villages, based on the ethnographic model of Papago bi-locational residence patterns. He talks about winter villages away from floodplains and creosote flats where summer villages are situated; unfortunately, he does not specify exactly where these prehistoric winter villages might be. Hence, it is not possible at this time to assess his suggestion in relation to a regional ecosystem.

REGIONAL CONCLUSIONS

The archeological and archeobotanical data presented above demonstrate that the Hohokam utilized each of the three major ecosystems discussed in this paper. Moreover, each of the ecosystems was utilized in a different manner than the one adjacent to it. Mode of utilization partly depended upon available water (Figure 99). When there was sufficient available water, Hohokam groups could conceivably support themselves year round on the floodplain by growing crops and harvesting weeds and riparian species such as mesquite. In good years, they probably made short excursions into



Occasional use: Constant use*

Rabbit hunting

May -- cholla bud gathering

June-July -- cacti and leguminous seed gathering

hunting parties -- large game

a. Sedentism with adequate rains at appropriate time. (Most extra-ecosystem task groups return to village same day.)

Seasonal occupation   Constant use*

intensified rabbit hunting

May -- cholla bud gathering

June -- cacti fruit gathering

July-August -- cacti and leguminous seed gathering

intensified hunting of large game in all zones

b. Semi-sedentism due to late rains or no rain. (Limited crop failure; population is mobile, with fewer people remaining in village; hunting and gathering are more intensified and of greater duration--camps are set up and used from two days to several months for more diversified resource exploitation.)

*Constant use: availability of water, cultivation of crops, hunting of rabbits and gathering of berries and greens.

Figure [illegible]. Three ecosystem subsistence-settlement model.

the foothills to gather favorite cacti and leguminous seeds (see Fig. 99a). During unavoidable years of insufficient available moisture, however, crops might fail to produce adequately and cause floodplain inhabitants to intensify gathering in the upper bajadas. The Hohokam may have also relied on additional fields in the creosote plain during these dry periods (see Fig. 99b). The three ecosystem model may not have been applicable from year to year, but over generations would allow for sedentism in the Papagueria.

These data suggest that the Hohokam inhabitants of the floodplain relied on catchment areas (Vita-Finzi and Higgs 1970) that ran from the upper bajada to the floodplain and on to the creosote plain. A site settlement and subsistence pattern evolved that seemingly was guided by behavior that:

A) Increased caloric returns by:

1) planting a food staple near a village,
2) planting supplementary fields in more marginal areas,
3) constructing reservoirs and trapping water for future use, and

B) Decreased energy expenditure by:

1) locating villages near water,
2) locating villages on the best arable land,
3) locating villages near abundant wild plant resources, and
4) specializing in key wild plants that provide copious amounts of foodstuffs from a single species that grow in close proximity to one another.

It is hypothesized that the system eventually became fixed, at least it apparently was operative during most of the Sedentary Period and into the Sells phase. This patterned behavior involved least-cost principles. Hence, it is predictable (Plog and Hill 1971: 11) and should apply to other areas in the Papagueria.

I see the Gu Achi site complex as another major wash floodplain village area (Figure 99). Masse (this volume) has already commented on the similarity of Gu Achi and the Santa Rosa Wash site. Further investigation of the environs near Gu Achi should reveal limited-activity gathering loci in the nearby mountains and supplemental field house loci farther out in the creosote plain. The Gu Achi archeobotanical food data, though collected from only limited excavations at this site, provide pan-ecosystem plant data of the sort one would have expected from the Santa Rosa Wash floodplain sites. In other words, the Gu Achi data indicate farming and settlement along Gu Achi Wash on the creosote floodplain as well as good evidence for specialized exploitation of the nearby montane cacti resources. The wild plant foods from Gu Achi and other sites discussed above were favorites of the historic Pima and Papago. Their frequency in other Hohokam sites suggests that they were prehistoric staples as well.

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APPENDIX 6

PREHISTORIC MAIZE FROM THE NORTH-CENTRAL PAPAGUERIA

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INTRODUCTION

To the casual observer, the Sonoran Desert appears to be an inhospitable environment for human habitation. Nevertheless, a site such as Ventana Cave indicates that it has adequately supported small bands of nomadic and semi-sedentary peoples for at least 10,000 years (Haury and others 1950). Initially, all subsistence was derived from wild plants and animals, but it was later supplemented by agriculture. According to estimates by Castetter and Bell (1942: 56-59), in an average year, 50 to 60% of the diet of the riverine Pima came from farming, 30% from wild food collecting, and 10% from hunting. Maize, beans, squash, gourds, tobacco, and cotton were the most important aboriginal crops. Mesquite and saguaro were the staple wild plant foods, supplemented by screwbean, cholla buds, and prickly pear fruits (see Bohrer 1970). Except for rabbits, game was never very important, but deer, mountain sheep, fish, and beaver were utilized when available. Lacking rivers, such as the Gila, as dependable sources of water for irrigation, the desert Papago relied much more heavily on wild plant collecting. Wild plant foods, such as saguaro and organ pipe cactus fruit, cholla buds, prickly pear fruit, agave hearts, mesquite pods, paloverde and ironwood seeds, various greens, and sand root, may have furnished as much as 65% of the diet (Castetter and Bell 1942: 56-59). Less reliable cultivated crops provided only 20% of the subsistence base. Animal protein from deer, rabbits, antelope, bighorn sheep, small rodents, and insect larvae (in decreasing order of importance) accounted for the remaining 15 percent.

MAIZE FROM THE GU ACHI SITE

The analysis of flotation samples by Robert Gasser (Appendix A) elucidates the local patterns of wild and cultivated plant usage in the Gu Achi area. The present paper deals with a more detailed analysis of the maize recovered by Gasser.

The entire collection of maize from Gu Achi consists of carbonized kernels from various loci on the floor of a burnt ramada. These kernels are described using standard measurements employed by other authors (Galinat and Gunnerson 1963; Cutler 1958, 1965; Miksicek n.d.). The results of the analysis are presented in Table 23. Samples from related contexts were combined. Two additional flotation samples, numbers 2 and 15, produced maize, but the kernels were too fragmentary to measure.

The Gu Achi site yielded only isolated kernels, most of which had been stored in the broken ceramic vessel in Feature 3, which was either a hearth or a pot rest. The rarity of cob fragments is consistent with a general trend noted by this author for Hohokam sites (other than dry cave sites). Apparently Hohokam food and seed corn was routinely shelled before storage, similar to the Pima and Papago practice of shelling corn prior to storing it in sealed granaries or ollas (Castetter and Bell 1942: 182-187). Among the Pueblo Indians, maize was usually stored on the cob. Corn was shelled immediately before use, and the cobs were frequently tossed into the cooking fire, where their preservation was promoted by charring. In contrast to Hohokam sites, cob fragments are ubiquitously recovered from Anasazi and Mogollon sites sampled by flotation.

Two races of maize were represented in the Gu Achi collection. The majority of the kernels (72%) were from a flinty variety, probably Onaveño (Wellhausen and others 1952), the most widely distributed type of corn grown by the Hohokam (Miksicek n.d.). The larger, broader grains belong to a second type, the flour corn, Maís Blando (Wellhausen and others 1952), which was introduced into the region around A.D. 700 (Miksicek n.d.). This is the only variety of maize that I have seen widely cultivated by the modern Pima and Papago. A few of the larger kernels of maize from Gu Achi approach the extremes of the eight-rowed, floury race Harinoso de Ocho. This belongs to a group of corn races, which contains both flour and flint varieties, collectively referred to as Mais de Ocho by Galinat and Gunnerson (1963: 121). Within the Mais de Ocho group is a broad genetic basis to adapt to a wide variety of environmental conditions. The Mais de Ocho group may have originated in South America, spread through Mexico, reaching southern Arizona by A.D. 700, and shortly thereafter diffused into the northeastern United States (Galinat and Gunnerson 1963). A member of the Mais de Ocho group, Northern Flint, was the first type of corn grown by the Pilgrims, and more recently it was one of the parental lines that was crossed to produce our modern, hybrid, dent corns.

Sixty-three percent of the measurable kernels from the Gu Achi site came from eight-rowed ears. For contemporaneous maize collections from southern Arizona that I have examined, the proportion of eight-rowed cobs ranged between ten and forty percent. The high percentage of grains from low row numbered cobs from the Gu Achi site poses a problem that is extremely difficult to resolve. An overly facile explanation is that they represent a more drought-resistant, eight-rowed flint corn. Unfortunately, a large proportion of the Gu Achi kernels ([illegible]%) were too distorted or fragmentary to determine accurately the basal angle and therefore estimate row number. The high percentage of eight-rowed kernels may be an artifact of preservation--a disproportionate expansion upon carbonization, resulting in a too wide basal angle and an erroneous row number estimate. Distortion could also be due to expansion of a kernel into an adjacent unpollinated row. Poor pollination could result from abnormally hot, dry weather conditions at the time of anther dehiscence.

The number of kernels produced on a cob is controlled by the interaction of several modifier genes and environmental conditions. Normally, in eight-rowed varieties the modifier genes that reduce row number are dominant. Twelve-rowed types have dominant modifiers that act in the opposite direction producing higher row numbers. Ear primordia differentiate early in the development of a corn plant and are sensitive to environmental stress. Low soil fertility tends to reduce row number (Emerson and Smith 1950: 6-7). Presumably, water stress during differentiation could act in a similar way to reduce row number. Whether the high proportion of eight-rowed kernels from the Gu Achi site reflects deliberate human selection of a more drought-resistant, low row numbered variety or whether it represents a stress-induced reduction of a normally higher row numbered variety is an ontogenetic argument that cannot be completely resolved at this time. A combination of these processes was probably in effect.

VENTANA CAVE MAIZE

Because of the proximity of the Gu Achi site to Ventana Cave, this author deemed it necessary to reexamine the large collection of maize recovered from Ventana Cave, which was excavated in the early 1940's under the direction of Emil W. Haury with the assistance of Julian D. Hayden and Wilfred C. Bailey. Human cultural remains were found in deposits ranging from late Pleistocene to historic Papago times. Because Ventana Cave was excavated before the advent of radiocarbon dating, Haury and Hayden based relative age estimates on geological, faunal, and ceramic evidence. After the publication of the first Ventana Cave monograph, Julian Hayden submitted charcoal and bone carbonate samples for radiocarbon dating that confirmed the Pleistocene age of the oldest culture-bearing horizons (Haury and Hayden 1975). The top meter of the cave fill, representing the last two millennia, was dry and yielded abundant organic remains. Unfortunately the lower layers were moistened by the perennial spring that brought human users to the cave; thus, organic preservation was poor. While it is believed that the earliest maize cultivation in the Ventana area was contemporaneous with the introduction of ceramics (at about the beginning of the Christian era), the top meter was so disturbed by rodent and human activity that more precise dating was not possible. A best-guess estimate places the majority of the Ventana Cave maize between A.D. 700 and 1700 (Emil W. Haury, personal communication); thus, it is possibly more recent than the Gu Achi material. In the future, perhaps some of the cobs themselves can be radiocarbon dated.

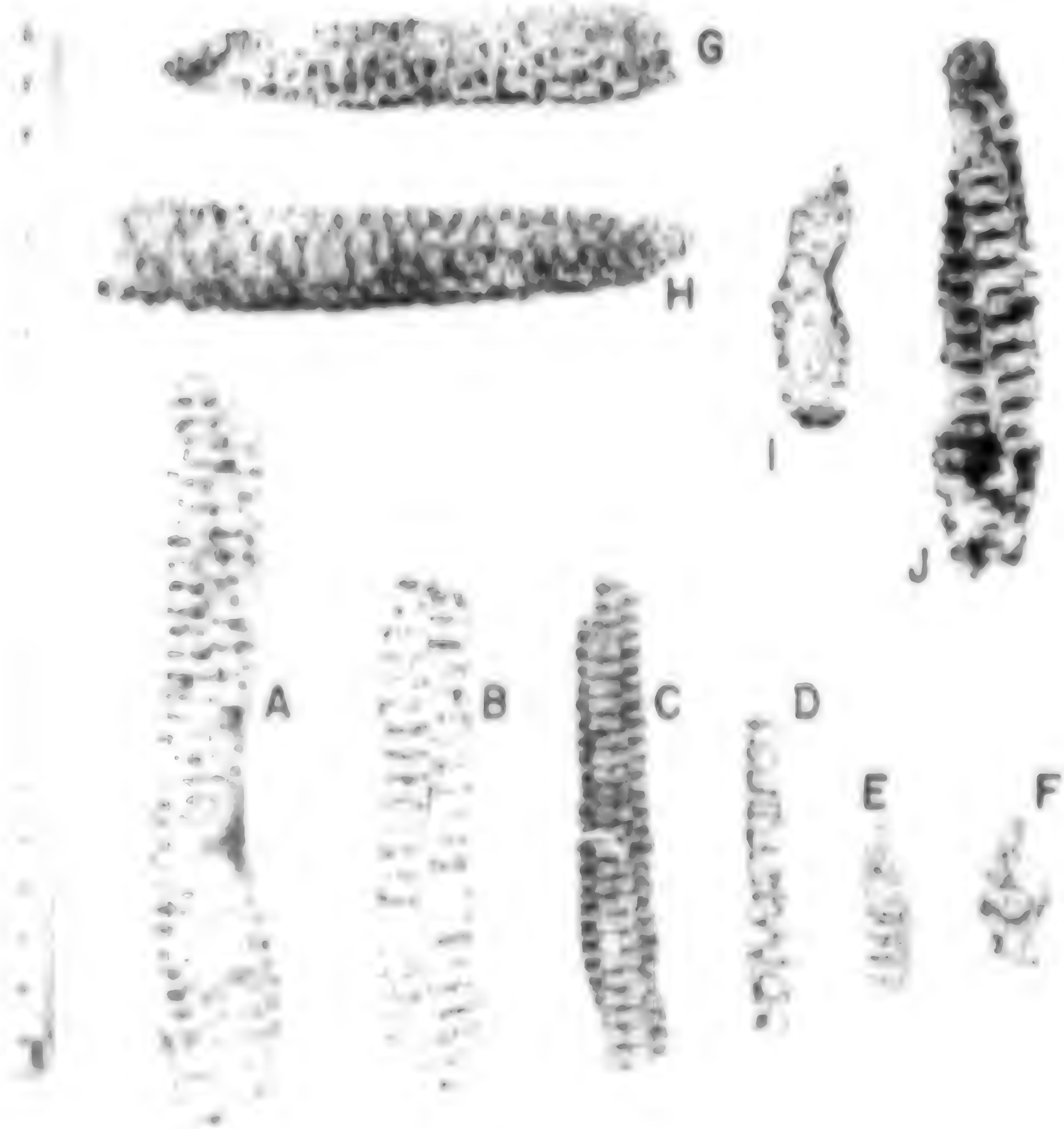
The initial analysis of the Ventana Cave maize was by Edgar Anderson of the Missouri Botanical Garden (in Haury and others 1975: 161-163). The collection was reexamined by this author in order to provide more detailed comparative data. In the deepest admiration for Dr. Anderson, it is remembered that "more is not necessarily better."

In contrast to the [illegible] cobs, all of the comparative [illegible] material consisted of desiccated, uncarbonized, whole cobs. To simulate the effects of carbonization and to facilitate comparison, a 20% shrinkage factor was applied to all measurements (Hugh Cutler, personal communication; shrinkage factor derived by experimental carbonization). Actual measurements for the [illegible] cobs are given in Table 24; "shrunken equivalents" are given in parentheses.

In general, the [illegible] collection had a high proportion of eight-rowed cobs. Five percent of the cobs examined were unpollinated or poorly developed cobs. Forty-one percent of the cobs exhibit a considerable amount of teosinte introgression as defined by Galinat and Gunnerson (1963). These teosintoid cobs were indurated, [illegible] almost equivalent of teosinte [illegible] (Fig. 180 [illegible]). The teosintoid cobs, like the [illegible], were [illegible]. Several cobs (Fig. 180 [illegible]) resemble Galinat's [illegible] "reid corn" (Galinat and Gunnerson 1963: [illegible]), [illegible] but with long glumes that partially cover the kernels in the most extreme example, but it was recovered from the same level that produced [illegible] a very typical Chapalote cob.

Teosinte is the closest [illegible] wild relative of maize. According to Galinat [illegible] (Galinat and Gunnerson 1963: [illegible]), teosinte is more drought resistant than maize, and this [illegible] could be transferred to maize by hybridization. Teosinte introgression also tends to [illegible] yield, a factor [illegible] important [illegible]. Teosinte introgression had a bidirectional effect on row number. It generally tends to reduce the number in most varieties, but it can also cause a slight increase in abnormally high row numbered types (Galinat and Gunnerson 1963).

The remaining 54% of the [illegible] cobs [illegible] of the [illegible] sequence of corn that includes both [illegible]. Without [illegible], it is difficult to distinguish between the two [illegible] alone. A number of cobs (such as [illegible] and [illegible], Fig. 180) had been [illegible]



VENTANA CAVE MAIZE

Fig. [illegible]. Cobs A-F show extreme amounts of teosinte introgression. Cobs D and F [illegible] formed at the bases of tassels. G and H are more typical [illegible] ears. Cobs I and J show evidence of cutting to remove kernels. Provenience: [illegible], and H, Excavation Unit [illegible], Upper Cave; I, J, [illegible], Lower Cave; A, B, Unit [illegible]-Level 2, Lower Cave; C, D, E, [illegible] Lower [illegible] G, Unit [illegible], Upper Cave.

the cobs were still immature, and the kernels were cut from the cob using a sharp instrument.

COMPARISONS AND CONCLUSIONS

A number of characteristics of the Gu Achi and Ventana Cave maize collection combine to suggest environmental stress during the time of prehistoric occupation. As will be noted below, data from other prehistoric Arizona maize collections also emphasize the possibility of environmental stress in the Papaguerian specimens.

1. The Gu Achi site yielded mostly flint kernels while the St. Mary's site near Tucson produced mostly floury kernels (see Table 7). The area around the Gu Achi site is most suitable for farming based on collecting slopewash and on a limited number of ak chin fields. (See Masse's discussion of farming features in this volume.) St. Mary's, however, was located on the Santa Cruz flood plain, where the river could be tapped for irrigation. Flour corn may be more productive in irrigated fields.

2. A number of ears with unpollinated rows were recovered from Ventana Cave. The extreme distortion of the Gu Achi kernels could also be due to poor pollination resulting from drought.

3. The high proportion of eight-rowed kernels at Gu Achi suggests a decrease in row number due to water stress.

4. If indeed the hybridization of teosinte with maize introduces hybrid vigor (and therefore increased productivity) and at the same time confers some drought resistance, then the significant amount of teosinte introgression evident in the Ventana Cave collections reflects an important adaptation for maize agriculture in the Sonoran Desert. Lower frequencies of introgression were reported by Galinat and others (1956: 108) for the Lower Ruin at Tonto National Monument (11%) and for Richard's Cave near Montezuma's Castle (23%).

The stands of wild teosinte nearest to the Ventana area are in southern Chihuahua, but even there teosinte is a weed associated with maize agriculture. It is more truly native to the area around the Valley of Mexico and further south. The Ventana Cave maize with a high proportion of teosinte

Sample	Kernels Measured	Type of Corn		% of Kernels of Each Row Number					Kernel Width (mm)	Kernel Thickness (mm)	Kernel Height (mm)
				8	10	12	14	16			
Gu Achi Site, Az. Z:12:13											
Samples 1, 3, 9	60	Flour	30%	57	30	13			7.3	5.0	6.7
Ramada floor		Flint	70%	67	14	11	4	3	6.2	4.4	5.7
Samples 11, 16	37	Flour	26%	60	20	20			7.6	4.6	6.2
Pot in fire hearth		Flint	74%	62	28	7	3		6.3	4.7	5.8
Samples 25, 28, 29	8	Flour	12%	1 8-rowed kernel					8.5	5.7	6.6
No provenience-- (general floor)		Flint	88%	57	28	14			6.3	4.4	5.4
St. Mary's Site near Tucson	120	Flour	67%	30	40	23	7		8.1	5.1	7.6
A.D. 700-1100		Flint	33%	40	43	10	7		6.8	4.5	7.2

Table 23. Maize kernel data for the Gu Achi flotation samples.

Sample	Number of Cobs	% of Cobs with Each Row Number 8	10	12	14	16	% Teosintoid Cobs	Cupule Width (mm)	Grain Thickness (mm)	Kernel Width (mm)	Mid Cob Diameter (mm)	Cob/Rachis Index	Cob Length (cm)
Ventana Cave AZ Z:12:5, Upper Cave													
A	4	25	50		25		25	7.0 (5.0)	4.2 (3.4)	5.0 (4.0)	15.6 (12.5)	1.44	9.1 (7.2)
B	20	20	55	15	10		25	7.2 (5.8)	4.3 (3.4)	5.4 (4.3)	17.6 (14.1)	1.37	6.7 (5.4)
C	9		67	33			11	7.2 (5.8)	4.4 (3.5)	5.4 (4.3)	17.9 (14.3)	1.33	7.4 (5.9)
D	9		33	67			0	6.8 (5.4)	4.2 (3.4)	5.5 (4.4)	17.4 (13.9)	1.33	6.0 (4.8)
E	8	12	88				50	8.3 (6.6)	4.2 (3.4)	5.9 (4.7)	17.6 (14.1)	1.33	8.5 (6.8)
F	12	42	42	17			50	7.9 (6.3)	4.2 (3.4)	5.6 (4.5)	17.5 (14.0)	1.30	
Lower Cave													
A	3	33	33	33			33	9.3 (7.5)	4.4 (3.5)	5.5 (4.4)	18.5 (14.8)	1.35	8.1 (6.5)
[illegible]	14		71	28			63	8.2 (6.6)	4.5 (3.6)	5.3 (4.3)	18.8 (15.0)	1.33	7.0 (5.6)
E	5	40	40	20			100	9.2 (7.3)	4.5 (3.6)	6.1 (4.9)	21.0 (16.8)	1.34	12.5 (10.0)
G	3		33	67			66	7.8 (6.2)	4.2 (3.4)	5.0 (4.0)	16.2 (13.0)	1.42	7.4 (5.9)
H	17	18	29	41	6	6	59	8.9 (7.1)	4.6 (3.7)	5.7 (4.6)	20.0 (16.0)	1.27	8.6 (6.9)
Onaveño	10		10	40	40	10		9.4 (7.5)	4.5 (3.6)	7.1 (5.7)	26.1 (20.9)	1.42	18.6 (14.9)
Maiz Blando	14		21	29	21	29		8.6 (6.9)	4.5 (3.6)	9.1 (7.3)	26.8 (21.4)	1.24	

Table 24. Maize cobs from Ventana Cave (correction for charring).

germ plasm reflects the deliberate human selection for, and maintenance of, a strain of corn that originated somewhat earlier and much further south.

For a brief period of time starting around A.D. 850, the combination of a slightly more drought-resistant, teosinte-introgressed maize with an efficient system for channeling slopewash into agricultural fields may have allowed the type of extensive field systems seen in the Gu Achi area, but not without a certain element of risk.

A short term increase in population, resulting from a minor increase in the productivity and reliability of the subsistence base, may have proven disastrous in the long run. In the historic Papago subsistence system discussed by Castetter and Bell (1942), agricultural products were a luxury item. If the crops failed, there was always enough wild plant food to support a small standing population. If, however, the standing population size increased, together with its reliance on cultivated foods, several successive years of crop failure could decimate the population. The wild plant food buffer in the immediate vicinity of the site would no longer be an adequate reserve. The population would be forced to migrate to a more reliable area, exploit more widely dispersed wild plant and animal communities, or beg, trade for, or steal food from neighbors that were unaffected by the crop failure. A combination of all these strategies would probably have been used. Castetter and Bell (1942) suggest that the Papago often went to live with, or traded for food with, the Pima in times of famine. The Yaqui and Apache were notorious for raiding their more sedentary, agricultural neighbors.

Raiding and trading are difficult responses to substantiate archeologically. It is much easier to identify an increase in specialized, intermittently occupied camps for wild food collecting and processing or a shift in the location of permanent sites to more favorable locales with dependable moisture for farming. These are the types of trends that will have to be identified in future regional surveys.

The development of a teosinte-introgressed maize and the development of an efficient water management technology, combined with an intensification of the use of widely dispersed, seasonal satellite sites for food collecting, could have allowed a fairly large, sedentary population in the Sonoran Desert.

APPENDIX C

ANALYSIS OF POLLEN FROM GU ACHI

By
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INTRODUCTION

Nine pollen samples were collected from the prehistoric Hohokam site of Gu Achi, seven of which were submitted to the University of Arizona Laboratory of Paleoenvironmental Studies for analysis. The modern surface sample (sample 9) was a composite sample taken near the trash mound (Locus G), along a 100-meter line through the site. The prehistoric samples were all obtained from Excavation Area 1 and were taken from an occupation surface (sample 1), pit bottoms (samples 3, 5, 7, and 8), and from the soil found in the bottom of a reconstructible storage vessel (sample 4). The locations of the prehistoric samples are depicted in Figure 91, in Appendix A. The occupation surface sample included a large amount of carbonized material, most likely associated with the burning of the ramada in Excavation Area 1. It was feared that pollen in this sample had been destroyed by burning, however, some countable pollen was obtained. All other samples also contained sufficient pollen for counting--as a "rule of thumb," 1,000 grains of pollen per gram of sample (Table 25).

After each sample (except sample 4) was mixed inside in its own bag, approximately 30 grams were removed for analysis. An attempt was also made to test the soil from sample 4, which appeared to have been in contact with the pot interior, in order to retrieve economic information. The pollen samples were extracted following a procedure discussed by Mehringer (1967). This method consists of concentration of pollen by swirling, followed by removal of calcium carbonate, silicates, humic acids, and cellulose by consecutive treatment with hydrochloric, hydrofluoric, and nitric acids and potassium hydroxide. The extracted pollen was transferred to glycerin stained with basic fuchsin. Prepared slides (except sample 0, 100 grains, and sample 1, 200 grains) were counted using 40x and 25x objectives to 300 grains.

RESULTS

Table 25 shows the estimated number of pollen grains per gram for each sample. Pollen was sparse in most, except in the modern surface sample and the pot interior, where it was moderately abundant. The number of grains that could not be identified due to poor preservation, expressed as a percentage of the pollen sum, was high for all the samples (Table 25) but seems to bear no relationship to the amount of countable pollen in the samples. These high figures mean that differential preservation may have had a large effect on the relative percentages of identifiable pollen types.

Percentages of pollen types in each sample are shown in Table 26. The most common taxa are the Compositae. These are subdivided into the wind-pollinated low spine Compositae (Ambrosia-type: ragweeds and bursages), the insect-pollinated high spine Compositae (all others), the wind-pollinated Gramineae (the grass family), and the wind-pollinated Cheno-Am (the family Chenopodiaceae, pigweeds, and the genus Amaranthus, amaranth). The pollen of higher elevation plants and insect-pollinated plants rarely occurs in abundance in desert archeological samples, such as the Gu Achi samples, except as the product of human activity.

The modern surface sample shows unusually high percentages of high spine Compositae and Gramineae pollen. A pollen transect from the Tucson Mountains to the Avra Valley (Hevly, Mehringer and Yocum 1965) shows pollen percentages for the modern pollen rain in the Sonoran Desert at several elevations. At stations about the same elevation as the Gu Achi site, the transect showed about 10 to 20 percent Cheno-am pollen, 10 percent Gramineae pollen, 5 to 10 percent high spine Compositae pollen, and 50 to 60 percent low spine Compositae pollen.

Sample No.	Provenience	Grain/Gram	Unidentifiable*
Excavation Area 1			
3	Occupation Surface	5,933	29.5
4	Bell-shaped pit	3,258	39.3
5	Pot Interior	22,678	26.3
6	Southern pit	5,859	46.6
7	Northwest pit	11,742	62.0
8	Central pit	8,967	47.3
Composite Surface			
9	Surface	14,120	46.4

*percent of the pollen sum.

Table 21. Estimated pollen grains per gram of sample and unidentifable grains for the Gu Achi samples.

Several explanations are possible for the great underrepresentation of low spine Compositae pollen in the modern Gu Achi sample. Among them are seasonal variation in the pollen rain, sampling bias, differential preservation and introduction of older or extra-local pollen in blowing dust. No single explanation is entirely satisfactory.

The ease with which certain pollen taxa can be recognized under conditions of poor preservation is another source of bias. For example, pollen of the Compositae (sunflower) family is easily identifiable even when poorly preserved, but if preservation is very bad, there is a tendency for the spines on the surface to become "melted away." Pollen of the low spine Compositae may lose its identifying spines altogether and fall into the unidentifiable category, while pollen of the high spine Compositae may still remain recognizable. This results in underrepresentation of the former, a problem which may apply to the Gu Achi samples.

Nevertheless, the prehistoric samples from all proveniences are fairly consistent, with lower low-spine Compositae and higher high-spine Compositae and Cheno-Am pollen values. The high-spine Compositae and Cheno-Am types both include disturbance weeds. The dominance of Cheno-Am pollen in desert archeological samples where farming probably took place is expectable. These Cheno-Am values suggest extensive disturbance at and near the site, but reflect the location of the site above, rather than immediately adjacent to, the floodplains of either of the neighboring washes. The most common insect-pollinated types are the Nyctaginaceae (four o'clock family) and the Malvaceae (mallow family). The former include primarily late summer blooming annuals and perennials while the latter includes plants blooming both in the spring and the summer. Since the pollen rain fell whether the site was occupied or not, these types provide no information about what times of the year the site was occupied.

The occupation surface sample produced a possible portion of a grain of *Zea* (maize)--the pore and part of the surrounding exine, one grain of *Cercidium* (paloverde), and one grain of *Agave*. The bell-shaped pit produced a definite grain of *Zea*. A possible grain of *Gossypium* (cotton) was found in the pot interior sample. The grain is definitely Malvaceae but not either the common *Sphaeralcea*-type, *Sidalcea*-type, or *Hibiscus*. Rather it compares well with *Gossypium*, though it is outside the range of the native desert cotton, *Gossypium* *thurberi* (Benson and Darrow 1944). The central pit sample yielded a possible grain of *Opuntia* (prickly pear). These grains do no more than indicate the presence of these plants at the site and, except for the maize and cotton, do not necessarily reflect human activities. The pot interior and central pit samples included small clusters of a few Cheno-Am grains. Since such clusters cannot be wind-dispersed, this suggests the presence of plant parts at the site. The pot interior also showed the highest percentage of Cheno-Am pollen of any provenience, but, given problems of bias due to poor preservation, speculation from this would be unwise.

CONCLUSIONS

The Gu Achi samples are most valuable for the information they add to the understanding of how human activities affected vegetation in specific environments. At least two variables are at work: (1) the location of the site as it affects or is affected by "natural" pollen rain and (2) the type and intensity of human activity at the site as it affects the "natural"

	Excavation Area 1						Surface
	1 Occupation surface	3 Bell-shaped pit	4 Pot interior	5 Southern pit	7 Northern pit	8 Central pit	9
Pinus	.5	.3	.3		.3		.6
Juniperus					.6		1.0
Quercus		.3					.2
Celtis	.5		.3		.3		.2
cf. *Cercidium*	.5						
Ephedra	.5				.3		.2
Larrea							.6
Koeberlinia-type							.2
High-spine COMPOSITAE	11.5	11.6	9.3	18.3	13.2	11.3	33.0
Low-spine COMPOSITAE	6.0	3.3	1.7	9.0	5.6	6.3	16.6
Artemisia		.3					.2
CHENO-AM	72.5	70.3	84.0	62.7	69.0	74.7	15.0
Tidestroemia	.5			.3	.3		
GRAMINEAE	3.5	7.0	.7	8.3	7.6	5.7	26.6
cf. *Zea*	.5	.3					
MALVACEAE	1.0	1.3	.3	.3	1.2	.3	.6
cf. *Gossypium*			.3				
NYCTAGINACEAE	2.0	1.0	.7	.7	1.2	.7	.8
Euphorbia-type		.7	.7			.7	2.6
LEGUMINOSAE			1.3				
CRUCIFERAE		.3		.3			
SCROPHYLARICEAE			.7				
cf. *Opuntia*						.3	
Agave	.5						
LILIACEAE							.2

Table 26. Pollen percentages from Gu Achi.

vegetation and alters the pollen rain. Using modern analogs, it may be possible some day to control the former and isolate the effects of the latter if enough data from enough sites are available. At this point, without being able to determine what this means in terms of specific activities, it is only possible to suggest that disturbance at Gu Achi was probably extensive.

The Gu Achi samples provide little information on economic uses of plants not already provided by the flotation analysis. The scarcity of economic plant pollen (such as maize pollen) at Gu Achi is in itself interesting information, but determination of its significance awaits future studies of how plant processing affects the economic pollen that is left in the archaeological record.

APPENDIX D

ARCHEOLOGICAL FAUNA FROM GU ACHI

by
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INTRODUCTION

This paper presents an analysis of faunal remains recovered from Gu Achi (AZ Z:12:13), a pre-Classic period Hohokam village on the Papago Indian Reservation, Arizona. Gu Achi is located in the northwest part of Pima County, about 105 airline km (65 miles) west of Tucson. The faunal assemblage from a second Hohokam site, Pisinimo, located about 40 km (25 miles) southwest of Gu Achi, was also analyzed by the author. A report on the Pisinimo fauna is on file at the Western Archeological Center (Johnson 1977).

The modern vegetation in the Gu Achi area has been discussed in detail earlier in this volume (see Chapter 2 and Appendix A). It may be characterized briefly as Lower Sonoran, with the dominant plants being *Larrea* (creosotebush) on the flatter areas, *Cercidium*-*Cereus* (paloverde-saguaro) association on the slopes, and *Prosopis*-*Acacia* (mesquite-acacia) riparian association along the Santa Rosa Wash floodplain.

The 776 bone elements recovered from Gu Achi, 98% of which are fragmentary, represent 11 species: 1 amphibian, 2 reptiles, and 8 mammals (Table 27). Fifty-six percent of the bone shows evidence of having been burned, and at least 50% of the bone is moderately to badly weathered, indicating exposure at the surface for an unknown period before burial or by recent erosion. No elements have obvious butcher marks or marks of

	Bone Fragments	Minimum # Individuals (M.N.I.)*		Bones Burned (%)		Bones Weathered (%)		Worked Bones
AMPHIBIANS								
Scaphiopus cf. *couchi* Couch's spadefoot toad	1	1	(1)	0	(-)	0	(-)	0
REPTILES								
Kinosternon sp. Mud turtle	2	1	(1)	0	(-)	2	(100%)	0
Pituophis melanoleucus Gopher snake	6	1	(1)	0	(-)	0	(-)	0
MAMMALS								
Lepus alleni Antelope jackrabbit	7	3	(2)	0	(-)	4	(57%)	0
Lepus californicus Black-tailed jackrabbit	18	3	(2)	1	(6%)	6	(33%)	0
Lepus sp. Jackrabbit	16	2	(2)	5	(31%)	9	(56%)	0
Sylvilagus sp. Cottontail rabbit	11	1	(1)	3	(27%)	8	(73%)	0
Ammospermophilus harrisi Harris' antelope squirrel	3	1	(1)	0	(-)	0	(-)	0
Taxidea taxus Badger	1	1	(1)	0	(-)	1	(100%)	0
Lynx rufus Bobcat	1	1	(1)	0	(-)	1	(100%)	0
Odocoileus hemionus Mule deer	4	2	(1)	2	(50%)	0	(-)	0
Ovis canadensis Bighorn sheep	347	4	(1)	334	(96%)	13	(4%)+	1
Artiodactyla (indeterminate) Deer, pronghorn, bighorn sheep	26	1	(1)	9	(35%)	25	(97%)	5
Large mammal (> coyote)	58	---		22	(38%)	56	(97%)	7
Unidentified bone fragments	275	---		55	(20%)	261	(95%)	0
Total bones, all species	776	22	(16)	431	(56%)	386	(50%)	13

*The number in parentheses refers to the M.N.I. calculated after lumping bones together without regard to provenience.

+The burned nature of the bone precludes an accurate evaluation of the amount of weathering.

Table 27. Faunal species present, minimum number of individuals, and modified bone from Gu Achi.

rodent gnawing, though the weathering of the bone surface may have obscured such features; however, 12 fragments exhibited signs of having been cut and polished for tool use. These included long bone fragments of the following: bighorn sheep (1 fragment); indeterminate artiodactyl (4 fragments); and indeterminate large mammal (7 fragments). In addition, an indeterminate artiodactyl phalange with a possible drill hole was recovered.

All of the animal species represented by the bones recovered from Gu Achi either are found in the area today or might have been had they not been extirpated by man; thus, no vegetational or climatic change is indicated by the faunal evidence. The faunal remains are scanty for such a large site, though it should be noted that at Gu Achi no trash mounds were sampled. A listing of identified faunal elements by provenience is given in Table 28.

DISCUSSION OF SPECIES

Amphibia

Couch's spadefoot toad--*Scaphiopus* cf. *couchi*:

This species is found in the region of the site today, living during dry periods in self-made burrows or abandoned rodent burrows. Spadefoot toads are active primarily during the period of spring and summer rain (Stebbins 1966: 56). The bone does not exhibit any evidence of human modification and may be from an animal that died in a burrow.

Reptilia

Mud turtle--*Kinosternon* sp.:

Two species of mud turtle can be found in southwestern Arizona today: the yellow mud turtle (*K. flavescens*) and the Sonoran mud turtle (*K. sonoriense*). Both species, unlike the desert tortoise (*Gopherus agassizi*), are highly aquatic and require the presence of a permanent body of water. Yellow mud turtles have been seen in recent years in water catchments (tanks) in the vicinity of Sells, Arizona, 42 km (26 miles) southeast of Gu Achi (Van Devender 1977: personal communication).

EXCAVATION AREA 1	Occupation Surface Antelope jackrabbit: (1 humerus) Blacktailed jackrabbit: (1 pelvis, 1 skull fragment, 1 ulna) Mule deer: (1 metapodial, 2 molar fragments) Bighorn sheep: (12 skull fragments, 1 femur) Artiodactyla: (1 tooth fragment, 1 metapodial fragment, 3 long bone fragments)
	Miscellaneous Proveniences Antelope jackrabbit: (1 humerus) Blacktailed jackrabbit: (3 ribs, 2 radii, 1 vertebra) Badger: (1 phalange) Bobcat: (1 phalange) Bighorn sheep: (14 skull fragments, 1 horn core fragment) Artiodactyla: (1 femur, 4 teeth fragments)
EXCAVATION AREA 2	Lower Occupation Surface Antelope jackrabbit: (2 pelvis fragments)
	Miscellaneous Proveniences Blacktailed jackrabbit: (1 ulna) Artiodactyla: (4 long bone fragments)
EXCAVATION AREA 3	Antelope jackrabbit: (1 pelvis) Blacktailed jackrabbit: (1 scapula, 1 tibia, 1 radius, 1 calcaneum) Cottontail rabbit: (1 incisor) Harris' antelope squirrel: (1 femur, 1 sacrum, 1 vertebra) Bighorn sheep: (323 skull and horn core fragments) Artiodactyla: (1 skull fragment, 1 tooth fragment, 1 vertebra)
EXCAVATION AREA 4	Mud turtle: (2 pleural bones) Antelope jackrabbit: (1 femur) Blacktailed jackrabbit: (2 phalanges, 1 metacarpal) Cottontail rabbit: (2 scapula fragments, 1 radius, 1 upper molar, 4 mandible fragments, 2 long bone fragments) Artiodactyla: (1 vertebra)
TRENCH A	Artiodactyla: (1 humerus(?), 1 tooth fragment)
AC QUAD	Artiodactyla: (1 humerus, 1 phalange, 1 long bone fragment)
BC QUAD	Bighorn sheep: (5 complete teeth, 2 tooth fragments, 6 mandible fragments)
BD QUAD	Mule deer: (1 patella) Bighorn sheep: (3 skull and horn core fragments) Artiodactyla: (1 tooth fragment)

Table 28. Distribution of identified faunal elements by provenience.

The source of the turtle remains at the Gu Achi site may have been the prehistoric reservoir, believed to be contemporaneous with occupation, which is located about 500 m northeast of the center of the site. The recovery of the remains of an aquatic mud turtle and the aquatic plant *Phragmites* (Gasser Appendix A) indicates that the reservoir may have contained water year round.

Turtle bones comprised 19% of the total number of faunal elements recovered from seven Classic period sites in the Quijotoa Valley, about 16 air-line km (10 miles) south of Gu Achi (White 1975: 245). Two of the sites, AZ A:14:21 and AZ Z:14:33 contained *Kinosternon* sp. The mud turtle was also reported from the Escalante Ruin Group (Sparling 1974).

Gopher snake--*Pituophis melanoleucus*:

Historic Pimans, as other Southwestern groups, did not eat snake, even in times of famine (Russell 1908: 83). Thus it is probable that the gopher snake remains are not associated with human occupation of the site.

Mammalia

Antelope jackrabbit--*Lepus alleni*:

Bones of adult *Lepus alleni* can usually be distinguished from those of *Lepus californicus* (black-tailed jackrabbit) by the overall size and robustness of the former. Greatly fragmented elements are designated *Lepus* sp.

The seven antelope jackrabbit bone fragments represent 14% of the total minimum number of individuals (M.N.I.) for all species recovered from the site (Table 27). Only one bone, a metacarpal, is complete, and four of the seven (57%) are badly weathered, indicating exposure for an unknown period before burial. No human modification of the bone is apparent. Jackrabbits do not occupy burrows and are less likely to be present as intrusive elements than burrowing forms such as toads, cottontails, and most desert rodents; thus, these remains can be attributed to aboriginal activities at Gu Achi.

Black-tailed jackrabbit--*Lepus californicus*:

The black-tailed jackrabbit is represented by 18 bones, only two of which are complete. Six bones are weathered, and one is charred. The three individuals represented comprise 14% of the total M.N.I. The average live weight (both sexes) of *L. californicus eremicus*, the subspecies that is common in the Gu Achi area today, is 2.4 kg (5.3 lb) (Vorhies and Taylor 1933). At this weight, an average-sized individual yields about 1.7 kg (3.7 lb) of usable meat. Black-tailed jackrabbit remains have been found in most Hohokam sites.

Cottontail rabbits--*Sylvilagus* sp.:

With relatively complete skulls or mandibles it is possible to discriminate among the three species of cottontail in Arizona, *Sylvilagus audubonii*, *S. floridanus*, and *S. nuttallii* (Hoffmeister and Lee 1963a, 1963b; Findley and others 1975). Although no diagnostic elements were recovered from Gu Achi, the animal most likely represented is *S. audubonii*, the desert cottontail. Three of the 11 bones recovered were burned, indicating human utilization. Cottontail bones exhibit weathered surfaces twice as often as those of the black-tailed jackrabbit in the Gu Achi faunal assemblage. This difference may reflect different cooking techniques for jackrabbits and cottontails; however, the sample size is very small, and thus a definitive conclusion is not possible.

Harris' antelope squirrel--*Ammospermophilus* (*Citellus*) *harrisi*:

The Harris' antelope squirrel is common in southwestern Arizona today (Cockrum 1960). The bones do not show evidence of human utilization; thus, the animal may have died of natural causes. However, Russell (1908: 81) reports that the Pimas poured water into the burrows of ground squirrels of various types "until they were driven out, whereupon they were killed with clubs or shot with arrows." They were eaten only by men and were "tabued to the women."

Haury (Haury and others 1950) lists chipmunk *Eutamias* sp. in the fauna of Papago Level 1 of nearby Ventana Cave. Chipmunks are not normally found in Sonoran Desert vegetation and at present do not range closer to Ventana Cave than the Catalina Mountains, about 100 km (62 miles) to the east (Cockrum 1960). It is possible that the Ventana Cave specimen is an incorrectly identified Harris' antelope squirrel or round-tailed ground squirrel (*Spermophilus* (*Citellus*) *tereticaudus*). Because of their small biomass, ground squirrels probably never were an important food resource except in that they added variety to the diet.

Carnivora

Badger--*Taxidea taxus*:

Badgers were eaten historically by Pimans, and "a badger tail is an essential part of the medicine man's equipment" (Russell 1908: 80).

Bobcat--*Lynx rufus*:

Although probably eaten, it is likely that bobcats were sought more for their skins, which were used by the historic Pima and Papago as arrow quivers (Russell 1908; Castetter and Underhill 1935). The referred specimen, a phalange, was badly weathered and did not show butcher or skinning marks.

Artiodactyla

Mule deer--*Odocoileus hemionus*:

The four elements, although fragmentary, are referred to as mule deer rather than white-tailed deer because of their relatively large size. The bones, two of which show evidence of having been burned, represent two individuals if provenience data are considered. All of the elements, however, could have come from a single individual. Mule deer remains have been found in most desert sites, and undoubtedly the species was an important food resource (Haury 1976: 114).

Bighorn sheep--*Ovis canadensis*:

Four individuals are represented in the site. Thus, bighorn sheep appears to be the most important animal food resource for the Gu Achi inhabitants. The value of calculating the M.N.I. is well illustrated in this instance. The 307 horn core fragments recovered from Excavation Area 3 (see Fig. 101) are probably from one individual. If these are subtracted from the total bighorn elements, the number drops from 347 to 40, a reduction of 88%. The M.N.I. does not change.

Bighorn are often represented primarily by skull parts, suggesting that skulls may have been brought to the village disproportionately to other skeletal elements. However, the number of bighorn sheep post-cranial bone fragments classified as indeterminant Artiodactyla is not known.

I believe bighorn sheep tend to be overrepresented in open sites because of the durability and ease of identification of skull fragments, especially those from horn cores. If skull fragments were removed from the Gu Achi bighorn sheep sample, the M.N.I. would be reduced from 4 to 2 (50%). Mule deer would then be co-dominant with bighorn sheep in terms of identified large mammal resources.

Deer, pronghorn, bighorn sheep, indeterminate:

The bones in this category have surface features and articular surfaces that place them in the Order Artiodactyla, but more precise identification is precluded by the fragmentary nature of the bone. If each feature is considered individually, a minimum of 7 individual animals is represented. However, the nature of the bone fragments themselves indicates they could have come from one individual, or from individuals already identified to the species level in each feature. The true number is probably somewhere between 1 and 7, which is a large range.

WORKED BONE

A total of 13 different objects of worked bone, most fragmentary, were recovered from the excavation of Gu Achi (Table 29). The small numbers of worked bone found and the fact that most objects were either bone tube fragments (5) or "awl" (or possibly hair ornament) fragments (6) are typical of worked bone assemblages from Hohokam sites (see Haury 1976: 302-305). A spatula-shaped large mammal long bone of unknown function and an artiodactyl first phalange with a possible drill hole are the other worked bone objects from Gu Achi.

At least two of the six "awls" found at Gu Achi are indeed awls rather than hair ornaments on the basis of their shape characteristics (see Fig. 102 c, d). These metapodial awls were found in the same location in Excavation Area 2, and both conceivably could have been fashioned from the same bone. The other four specimens could either be awls or hair ornaments. One of these, the tip of which is illustrated in Figure 102b, can be reconstructed to a length of 18.7 cm.

One complete bone tube was encountered on the occupation surface of Excavation Area 1 (Fig. 102a). It was manufactured from the middle portion of a bighorn sheep femur. This represents the only worked bone specimen that was identifiable to species; the others could only be classified either as "large mammal" or "indeterminate artiodactyl." Three of the other specimens of bone tubes, each a small fragment, were probably fashioned from femurs while the remaining specimen was most likely made from a humerus.

The spatulate object is fragmentary and its original length is unknown. The present dimensions are 6.3 cm in length, 1.3 cm in width, and 0.5 cm in thickness. The unbroken end has been rounded by grinding either from use or during the course of its manufacture. It is possible this object might have been an "awl," but its general shape and the rounding of the unbroken end make it distinct from most other awls. Similar specimens have been reported from Snaketown (Gladwin and others 1937: Plate CXXVa) and Ventana Cave (Haury and others 1950: Fig. 88f). Haury suggests that they may have been used as "fleshing" tools (1950: 379).

The final possible worked bone is the previously mentioned artiodactyl first phalange. This specimen appears to have had a hole drilled through the distal articulation at a right angle to the long axis of the shaft. Unfortunately, the specimen is badly weathered and a portion of the distal articulation is missing; the identification of a drill hole is thus speculative. Perforated bones seem to be rare for the Hohokam (see Haury and others 1950; Haury 1976), heightening the suspicion that the Gu Achi specimen may not have been intentionally drilled.

A list of the worked bone specimens from Gu Achi, including their provenience and distinguishing characteristics, is provided in Table 29.

	Provenience	Tool Type	Species*	Element Utilized	Comments
EXCAVATION AREA 1	0-12"	bone tube	L.M.	femur(?)--shaft midsection	small fragments
	12-24"	bone tube	L.M.	femur(?)--shaft midsection	small burned fragment; probably worked before burning
	19.5-27"	awl(?)	L.M.	longitudinally split long bone fragment	well-polished slender tip fragment; length 7.6 cm (Fig. 102b)
	occupation surface (below 30")	bone tube	bighorn sheep	femur--shaft midsection	specimen complete; length 9.8 cm maximum diameter 2.6 cm (Fig. 102a)
EXCAVATION AREA 2	0-12"	awl(?)	I.A.	metatarsal--proximal end	fragmentary but reconstructible; length 18.7 cm; possibly used as hair ornament (Fig. 102e)
	12-24"	awls(2)	I.A.	metapodial--proximal end	the awls may have been fashioned from opposite sides of the same bone (Figs. 102c, d)
	36-40"	flesher(?)	L.M.	longitudinally split long bone fragment	burned and fragmentary; width 1.3 cm; extant length 6.3 cm
EXCAVATION AREA 3	12-18"	bone tube	L.M.	femur(?)--shaft midsection	fragmentary and lightly weathered
	12-18"	awl(?)	L.M.	longitudinally split long bone fragment	small fragment
EXCAVATION AREA 4	hearth	awl(?)	L.M.	longitudinally split long bone fragment	small fragment
TRENCH A	12-24"	bone tube	I.A.	humerus(?)--shaft midsection	heavily weathered fragment; diameter 2.3 cm
AC QUAD	surface	bead or pendant(?)	I.A.	first phalange	possible drill hole through distal articulation; heavily weathered

*L.M. - Large Mammal; I.A. - Indeterminate Artiodactyl

Table 29. Provenience and distinguishing characteristics of the Gu Achi worked bone.

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SUMMARY AND CONCLUSIONS

Faunal remains from archaeological sites in the northern Sonoran Desert often are dominated by jackrabbits (*Lepus alleni* and/or *L. californicus*) and cottontail rabbits (*Sylvilagus audubonii*). The Hohokam levels in Ventana Cave yielded 597 rabbit bones (Haury and others 1950), and rabbit bones "were not only abundant but were in the overwhelming majority over those of other animals" in [illegible] both [illegible] at [illegible] (Haury and others 1950: 161). Rabbits comprise 61.5% of the minimum number of individual animals of all species recovered from Snaketown (Greene and Mathews 1976), 89.[illegible]% of the M.N.I. from Las Colinas (Johnson 1977), [illegible]% of the M.N.I. from the Escalante Ruin Group ([illegible] 1974), and [illegible]% of the total identifiable bones from seven Classic period sites in the [illegible] Valley ([illegible] 1976: 116).

It is often stated that larger animals, such as deer, are underrepresented in archaeological sites because their greater body weight necessitates more complete processing of the carcass at the kill site. This has been called the "schlepp effect" by Daly (1969). However, Thomas (1971) argued convincingly that a much more important factor in the patterning of faunal remains in a site is the presence or absence of dogs contemporaneous with occupation. Large bones are inherently more durable and cannot be ingested whole. Smaller bones are commonly found in [illegible] and coyote stomachs and scats, indicating that these predators can and [illegible] [illegible] these bones.

The domestic dog (*Canis familiaris*) was recovered from Snaketown (Greene and Mathews 1976), Las Colinas (Johnson 1977), and the Escalante Ruin Group ([illegible] 1974). In Ventana Cave (Haury and others 1950) dogs were reported in all levels except Level 1, representing an association of dogs with people for several thousand years. Dogs are probably underrepresented at most sites because of the difficulty in distinguishing between the bones of coyotes and coyote-sized dogs. Modern reservation dogs do not look well fed, and it is likely that they hunt their food much like coyotes and bobcats. If their Hohokam counterparts did the same, perhaps most of the rabbit bone deposited in the village by the human inhabitants would have

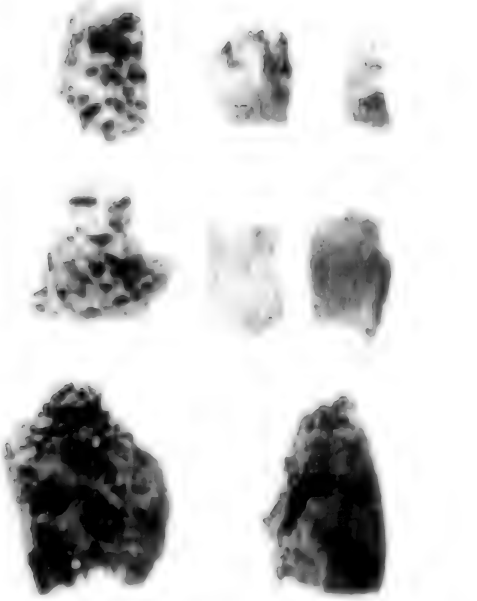

Fig. 101. Bighorn sheep horn fragments from Excavation Area 1. Length of lower right specimen, 3.5 cm.

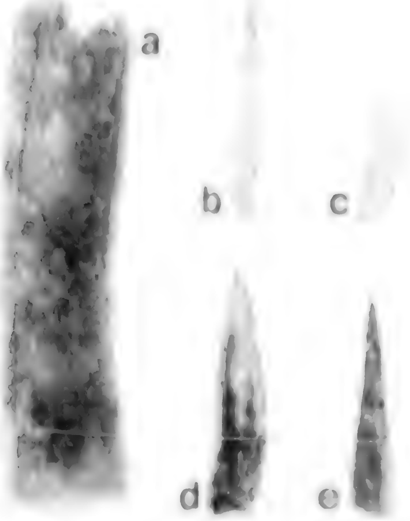

Fig. 102. Worked bone from Gu Achi: (a) tube; (b-e) awls. Length of e, 8.7 cm.

been broken into small unidentifiable bone fragments or carried out of the village. I suggest that this phenomenon brings the proportion of large to small animals closer to that actually utilized. It is possible that some small animals are more significantly underrepresented than larger ones. For a more detailed discussion of this problem, the reader is referred to Johnson (in press).

Rabbit bones comprised 31% of the Gu Achi M.N.I. and 77% of the [illegible] M.N.I. (Johnson 1977), respectively; thus both sites concur with a proposed overall pattern in which rabbit dominates the faunal list. However, if the M.N.I. reflects the actual proportions of each species utilized, then bighorn sheep and mule deer were the most important food resource for the Gu Achi people because of the much larger yield of usable meat per individual. Unfortunately, the small size of the Gu Achi excavated sample precludes generalizations at this time. Occupation of Gu Achi during a particular season is not indicated by the fauna. The presence of the mud turtle in the [illegible], however, suggest that a permanent water body (the presumed reservoir) was nearby.

APPENDIX E

SHELL FROM GU ACHI

by
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INTRODUCTION

Two hundred and eighty-four pieces of shell were collected during the work done at Gu Achi. Six were from late Snaketown phase deposits, [illegible] from Santa Cruz and Sacaton phase deposits, four from Sells phase contexts, and 153 from surface proveniences of uncertain or mixed time periods. In the following, the shell is discussed according to the time period to which it is attributed.

Table 30 lists all shell recovered from Gu Achi (AZ Z:[illegible]). One species of freshwater clam, one species of land snail, and at least seventeen species of marine shell are represented. In the tables, the number in parentheses following an entry is the number of specimens of that species found at the site.

The taxonomic names used in the tables follow Keen (1971). Two of these species are probably more familiar to archeologists by their older names. In the older literature *Argopecten circularis* is often referred to as *Pecten circularis* or *Aequipecten circularis*, and *Columbella fuscata* is also seen as *Pyrene fuscata*.

All of the marine shells listed in Table 30 can be found in the Gulf of California (Sea of Cortez), and *Laevicardium elatum* and *Pteria sterna* can also be found on the Pacific coast. *Anodonta californiensis*, a small freshwater clam with a nacreous shell, would have been available prehistorically in almost any major freshwater stream. Unless Gu Achi Wash or Santa Rosa Wash flowed perenially, the Gila River would probably have been the

Marine:

Glycymeris sp.	(128)
Glycymeris strigilata Sowerby	(1)
Dosinia ponderosa Gray	(1)
Laevicardium elatum Sowerby	(90)
Trachycardium panamense Sowerby	(1)
Pecten vogdesi Arnold	(7)
Argopecten circularis Sowerby	(2)
cf. *Anadara* sp.	(1)
Spondylus calcifer Carpenter	(8)
Spondylus cf. *princeps* Broderip	(1)
Pteria sterna Gould	(1)
Conus perplexus Sowerby	(2)
Agaronia testacea Lamarck	(1)
Olivella dama Wood	(8)
Cerithidea albonodosa Gould and Carpenter	(1)
Turritella leucostoma Valenciennes	(1)
Columbella fuscata Sowerby	(1)
Melongena patula Broderip and Sowerby	(5)
unidentifiable	(14)

Freshwater:

Anodonta californiensis Lea	(1)

Terrestrial:

Succinea sp.	(15)

Table 59. Marine, freshwater, and terrestrial shell species from Gu Achi.

nearest source of this shell. *Succinea* sp. is a small (up to about 12 mm in length), fragile turbinate land snail whose habitat requirements are only poorly understood. In general, this species is thought to prefer moist living conditions.

Numerous examples of *Glycymeris gigantea* were identified (by their large size) among the shell bracelets from Gu Achi. Since both *G. gigantea* and *G. maculata* were used by the Hohokam and since these species are often indistinguishable when small, fragmentary, or weathered, all *Glycymeris* material (except the single example of *G. strigilata*) from Gu Achi will be referred to here simply as *Glycymeris* sp.

Preservation of shell in both surface contexts and excavation units at Gu Achi is good though there are spots or encrustations of caliche on many of the shells. Many specimens also exhibit what is apparently solution weathering only, but it is not known if this occurred on the sands of the beach or in the sandy soil of Gu Achi. They display very smooth, shiny surfaces and rounded edges and occasionally have a grayish, slightly translucent appearance. Again, such specimens come from both surface and excavation units.

Within each time period, the shell from Gu Achi will be discussed by artifact types, following the terminology used by Haury (1937b; 1976) for the shell at Snaketown. Table 31 incorporates species and provenience information with artifact type for all material from the site. Complete provenience information and species identifications (for the *Glycymeris* shells) can be found in the analysis forms for Gu Achi, which are on file with the National Park Service, Western Archeological Center, Tucson, Arizona.

Concerning terminology, a note on *Glycymeris* bracelets is appropriate here. For plain shell bracelets, Haury (1976: 313-314) has constructed a three-category typology based on the width and thickness of the bracelet band, the shape of the band cross section, and the treatment of the umbonal area. In applying this typology to the material at Snaketown, Haury discerned some general temporal trends. Type 1 bracelets (thin, delicate bracelets) predominate in early phases but survive into later times. Type 2 bracelets (bracelets of medium thickness) are dominant in late Colonial and Sedentary times, and Type 3 bracelets (thick, massive bracelets) appear in the Sedentary Period. Thus (Haury 1976: 315), "the trend was from a

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		(Santa Cruz/Sacaton Phases)												(Sells Phase)					
Glycymeris sp., carved bracelet																		1	1
Glycymeris sp., plain bracelet	1	8	13	1		3	1		1									30	58
Glycymeris sp., incised bracelet	1																		1
Glycymeris sp., bracelet debitage		2	2	1	1		1	1		1		1						22	32
Glycymeris sp., finger ring		1																8	9
Glycymeris sp., finger ring debitage																		2	2
Glycymeris sp., perforated shell					2														2
Glycymeris sp., whole shell pendant			1																1
Glycymeris sp., worked		1	1	1	2													1	6
Glycymeris sp., unworked																		14	14
Glycymeris multicostata, whole shell pendant	1																		1
Dosinia ponderosa, unworked														1					1
Laevicardium elatum, [illegible] coated		1																	1
Laevicardium elatum, perforated shell		2	3															3	8
Laevicardium elatum, pendant		4		1														2	7
Laevicardium elatum, [illegible]		1										1							2
Laevicardium elatum, worked		1	2	1														5	9
Laevicardium elatum, unworked		10	11	2	1	1				1								35	61
Trachycardium consors, bracelet						1											1		2
Pecten vogdesi, pendant				1			1						1					1	4
Pecten vogdesi, unworked				1	1													1	3
Argopecten circularis, perforated shell																		1	1
Argopecten circularis, unworked		1																	1
cf. *Anadara* sp., unworked																		1	1
Spondylus calcifer, unworked		1	1		2													4	8
Spondylus cf. *princeps*, worked	1																		1
Pteria sterna, unworked																1			1
Conus perplexus, whole shell bead																		1	1
Conus perplexus, tinkler																	1		1
Agaronia testacea, unworked	1																		1
Olivella dama, whole shell bead			1								1						1		3
Olivella dama, unworked																		2	2
Cerithidea albonodosa, whole shell bead													1						1
Turritella leucostoma, worked																	1		1
Columbella fuscata, unworked		1																	1
[illegible], unworked															1				1
unidentifiable, unworked		1	1															1	3
unidentifiable, worked		1	2	1	1											1		5	11
Anodonta californiensis, unworked		1																	1
Succinea sp., unworked			5	6	1														12
TOTAL	6	61	46	20	16	4	3	3	1	7	3	1	7	2	1	3	6	127	284

Table 31. Gu Achi shell by provenience

thin-banded, delicate bracelet with extensively reduced umbo to a heavy-banded, bulky form with little or no modification of the umbo. The intermediate form, Type 2, is also intermediate in terms of time/frequency placement.

Concerning the procurement of *Glycymeris* shell, and shell in general, nothing needs to be added to Haury's (1976) and [illegible] discussions. The Hohokam probably obtained their shell through their own expeditions to the Gulf of California as well as from [illegible] trading expeditions to [illegible]. Haury's observation (Haury and [illegible]) that the majority of shell used in prehistory was probably old, dead shell, rather than fresh, is supported by the material from [illegible] [illegible] [illegible] of large pieces of *Glycymeris* shell [illegible] [illegible] and [illegible] bracelets [illegible].

As can be seen in Table [illegible] it is probable that [illegible] of the shell at [illegible] had been on the beach or dead in the water for some time. At least two bracelets appear to have traces of [illegible] caused by worm holes (Fig. [illegible]). The use [illegible] of fossil shell [illegible] [illegible] suggests that the craftsmen at [illegible] were experiencing the same supply problems Haury (1976: 307) noted at Snaketown, [illegible], that [illegible] was most in use during the [illegible] when shell working was at a peak among the Hohokam, and [illegible] apparently could

OLD SHELL			FRESH SHELL	INDETERMINATE
Beach-worn; worm holes, worm shells on shell	Appears old (color at [illegible])	Fossil (same breccia matrix)	[illegible] natural coloring	Shows no traces of either old or fresh shell
23	4	1	–	26
189	46	15	14	[illegible]
	[illegible]		14	[illegible]

Table [illegible]. The use of old versus fresh shell in *Glycymeris* bracelet manufacture.

not fill the demand. Often cemented breccia matrix still adheres to shell interiors or, as in the example from Cu Achi (Fig. 103a), is packed into the umbonal recess. The fossil shell may come from late Pleistocene deposits near Punta la Cholla (Haury 1976: 307). One bracelet with breccia matrix was found at Ventana Cave (Haury and others 1950: 368). Stanislawski (1963: 37) has reported a cache of 41 Glycymeris gigantea valves from Tucson, a number of which appear to be fossil material. One other broken, unfinished Glycymeris bracelet of fossil shell was seen on survey at Cu Achi but was not collected.

SNAKETOWN PHASE

Although only six pieces of shell were collected from deflated Snaketown Phase age components (Locus P), they are of particular interest because they not only suggest that a wide variety of shell species was being utilized at Cu Achi at an early date but also indicate strong stylistic ties, at an early date, with Hohokam "core" areas to the north and east. Marine species recovered from this component are listed in Table 33.

Three bracelet fragments were found, all of Glycymeris sp. One was

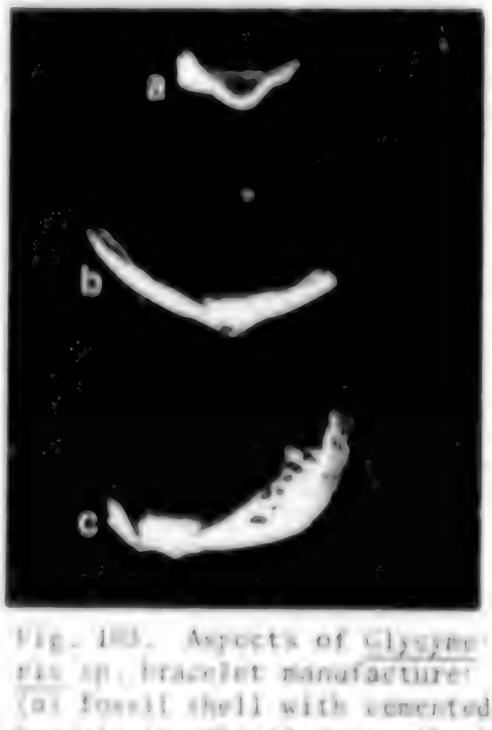

Fig. 103. Aspects of Glycymeris sp. bracelet manufacture: (a) fossil shell with cemented breccia in umbonal area, (b-c) bracelets broken along worm holes. Length of c, 5.0 cm.

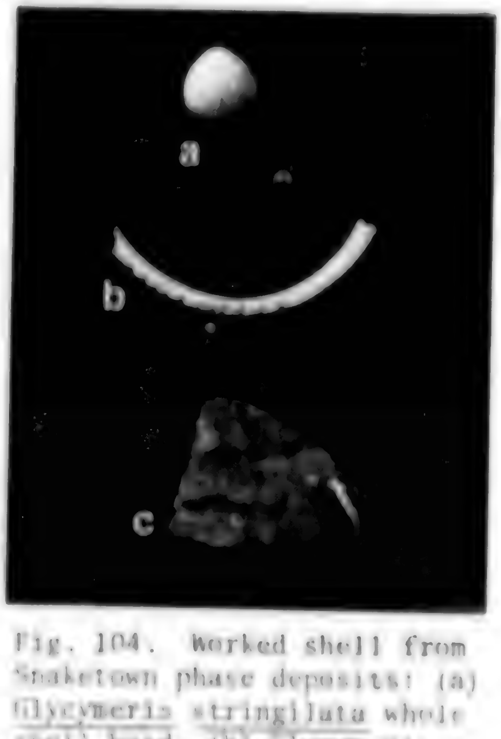

Fig. 104. Worked shell from Snaketown phase deposits: (a) Glycymeris stringilata whole shell bead, (b) Glycymeris bracelet fragment with marginal nicking, (c) ground Spondylus. Length of b, 4.7 cm.

Glycymeris sp.	(3)
Glycymeris stringilata Sowerby	(1)
Spondylus cf. *princeps* Broderip	(1)
Agaronia testacea Lamarck	(1)

Table 33. Shell species from the Snaketown phase at Gu Achi

a Type 2 bracelet while two were Type 1 bracelets with what Haury (1976: 313-314) has termed marginal nicking. These are bracelets with regular nicks or notches in the shell edge (Fig. 104b), added, presumably, to imitate the natural margin teeth that are ground flat in the extensively thinned Type 1 bracelets.

One whole shell pendant of a small *Glycymeris stringilata* shell was found (Fig. 104a). The beak of this valve was simply ground down until a perforation suitable for a suspension hole was made. A tongue-shaped fragment of *Spondylus* cf. *princeps* (Fig. 104c), ground on all unbroken edges and with the exterior surface sculpturing ground flat, was also found. Although this naturally bright-colored shell has weathered to a gray color, this specimen does not appear to have been burned. There are no wear marks that suggest a utilitarian function, and it is presumed that it is a fragment of some large ornament, possibly a pendant. Finally, one unworked fragment of *Agaronia testacea* was found. This is an *Oliva*-like gastropod.

SANTA CRUZ/SACATON PHASES

Excavation at Gu Achi yielded 141 pieces of shell from loci of this time period, representing at least eight marine species, one species of freshwater clam, and one species of land snail. These are listed in Table 34.

Bracelets. A total of twenty-eight fragments of plain *Glycymeris* bracelets was found. Classified in accordance with Haury's (1976) typology, four are Type 1, fifteen are Type 2, six are Type 3, and three were unclassifiable (Table 35). According to Haury's remarks quoted earlier (1976: 313) about the popularity of the various bracelet types through time, these are expectable ratios for a Santa Cruz/Sacaton age component.

Glycymeris sp.	(57)
Laevicardium elatum Sowerby	(48)
Pecten vogdesi Arnold	(5)
Argopecten circularis Sowerby	(1)
Spondylus calcifer Carpenter	(4)
Olivella dama Wood	(3)
Cerithidea albonodosa Gould and Carpenter	(1)
Columbella fuscata Sowerby	(1)
unidentifiable	(7)
Anodonta californiensis Lea	(1)
Succinea sp.	(13)

Table 34. Shell species from the Santa Cruz/Sacaton phases at Gu Achi.

Rosenthal (Rosenthal and others 1978: 203) has recently stated that Haury's typology of plain bracelets was not supported by data from the Quijotoa Valley Project. The present author, however, feels that the trends Haury has outlined for temporal changes in bracelet styles are applicable outside of Snaketown. The data from Gu Achi, while meager, suggest these trends are valid in the Papagueria as well. Rosenthal's comparisons of an unstated number of bracelets from a late Sedentary period site (AZ Z:14:21) with an unstated number from a Classic period site (AZ Z:14:33) seem a dubious basis on which to evaluate Haury's typology, particularly when it is remembered that Haury is speaking of trends, gradual shifts in preferences. The proportions of bracelet types do not change dramatically at arbitrary temporal boundaries.

Eighteen pieces of debitage resulting from the manufacture of *Glycymeris* shell bracelets were also recovered from the Santa Cruz/Sacaton age deposits. A more extensive discussion of bracelet manufacture is presented in the "Miscellaneous Surface" section below.

Finger rings. Trends in size and decoration of finger rings generally follow those for bracelets. Early rings are thin, made from small *Glycymeris* shells, while later (Colonial and Sedentary period) rings are heavier, being made from the umbonal area of large *Glycymeris* shells. Fragments of three finished finger rings were found in the Santa Cruz/Sacaton deposits.

Perforated shells. "Bivalves with large perforations constitute a group of shell products, the specific purpose of which are not obvious, although ornamentation in a broad sense may be inferred." This is the definition given by Haury (1976: 316) for perforated shells. Examples of Glycymeris sp. and Laevicardium elatum perforated shells were found at Gu Achi. Both Glycymeris specimens are from Excavation Area 4. One of them (Fig. 105a) is burned. Five fragments of L. elatum perforated shells were found, one of which has what appears to be a bead hole drilled in one edge (Fig. 105b). The large number of L. elatum perforated shell fragments suggests that this type of artifact, along with shell bracelets, was being manufactured in some quantity. The proveniences in which perforated shells were found at Gu Achi shed no light on their possible function.

Pendants. Whole shell pendants as a class are represented by one complete, small Glycymeris valve and three Pecten vogdesi valves. The only modification of the Glycymeris valve is that the interior face of the umbo has been ground through, creating a suspension hole. The P. vogdesi pendants are all made from the left (flat) valve, have a drilled suspension hole near the umbo, and have ground margins. Two are made from whole valves; the third is a small fragment (2 cm long) ground to a roughly oval shape. Whole

	Type 1	Type 2	Type 3	Unclassifiable
Excavation Area 1	2	4	2	0
Excavation Area 2	2	8	1	1
Excavation Area 3	0	0	0	1
Excavation Area 5	0	1	3	1
Excavation Area 6	0	1	0	0
Excavation Area 15	0	1	0	0
Totals	4	15	6	3

Table 35. Typology of plain bracelets from Santa Cruz/Sacaton phase deposits.

Small pecten pendants occur in the greatest numbers during the Santa Cruz and Sacaton phases at Snaketown (Haury 1976: Figure 15.16) and during the Rillito and Rincon phases at the Hodges Ruin (Kelly and others 1978: Table 3.3). Such pendants were also found in a Rincon phase cremation at the Tinaja Canyon Site (AZ DD:8:12S) in the middle Santa Cruz River Valley (Ferg 1977a: 159).

Cut shell pendants were scarce at Gu Achi relative to the amount of other types of manufacture. Five, of L. elatum, are of Santa Cruz/Sacaton age. One, excavated from Excavation Area 3, is apparently the torso, hind leg, and tail of a quadruped in profile (Fig. 106b). Four toes and a zigzag line are incised on the shell interior. The zigzag lines run between three small drilled dots and what is presumably the anal area of the animal.

The other four pendants were recovered from Excavation Area 1. The shape of the largest cannot be determined. One straight edge is ground; the other three are broken away. Another fragment was apparently a square with rounded corners (now broken in half). The suspension hole was being drilled on the shell interior when the shell broke. The third pendant fragment (Fig. 106a) is probably an appendage of some sort, possibly a bird's wing. The last, and most ornate, pendant fragment is shown in Figure 106c. What this piece may represent is unknown. Under the centrally placed biconically drilled suspension hole is a wing-like element that is repeated on the reverse (interior) of the shell. The right end is broken away while the left has a large hole drilled through it. No descriptions of pendants of similar configuration were located in the literature search.

Geometrics. Two discs of L. elatum were found at Gu Achi (Fig. 105h, i). The first is 19.6 mm in diameter, with all surfaces ground smooth. This piece does not have a bevelled edge, which suggests it was not intended for use in mosaic work. Whether this is an unfinished mosaic piece, an ornament, or a finished item (such as a gaming piece of some sort) is unknown. The second disc is approximately 15 mm in diameter and exhibits grinding mainly on the edges, the top of the valve being only lightly ground. As with the first specimen, the edges are not bevelled.

Beads. Five beads of Santa Cruz/Sacaton age were recovered at Gu Achi. Three are whole shell beads of Olivella dama made by grinding the spire to

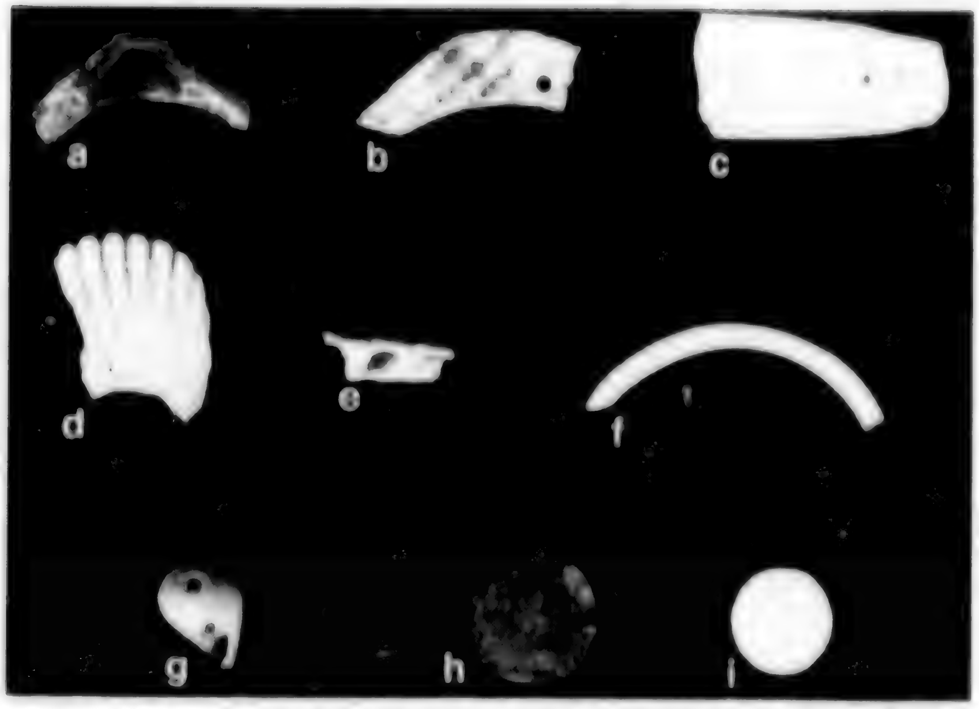

Fig. 105. Worked shell in probable Santa Cruz/Sacaton phase association: (a) *Glycymeris* sp. perforated shell, (b) *Laevicardium elatum* perforated shell, (c) ground section of a large univalve, (d) *Argopecten circularis* perforated shell, (e) ground half-cylinder of *Turritella leucostoma*, (f) awl or needle made from *Glycymeris* sp. bracelet fragment, (g) *Conus perplexus* bead, (h-i) *Laevicardium elatum* ground discs. Length of c, 5.8 cm.

create a suspension hole. One is a whole shell bead of *Cerithidea albonodesa* made by punching a hole through the dorsum for suspension. One is an irregularly shaped (possibly unfinished), flat disc-like bead made from an unidentifiable scrap of shell.

Elsewhere (Ferg 1977a: 158), the relative abundance of *Olivella* beads has been used as an index of the similarity of sites or as a guide to relationships among the sites. Further consideration of the matter suggests that this is a less than completely appropriate trait for drawing comparisons in that it appears to be subject to sampling errors. When *Olivella* beads, or any beads for that matter, are found in quantity, it is often as a cache, a necklace, or a funeral offering (see Hemmings 1969; Haury 1938: 138; Stanislawski 1961; Haury and Gifford 1959; Fulton and Tuthill 1940;

Plate IX; Ferg 1977a: 157). This may be due to the nature of beads; they are small and many are required to create one ornament. Thus, in both storage and use, many, rather than one or two, are ordinarily found. Hence, if only a few beads are found at a site, this should not automatically be interpreted as meaning that the people at the site had or made few beads. The excavator may simply have missed the cache, necklace, or cremation which contained them all. In conclusion, using the amount of beads at a site as a trait by which to compare sites seems invalid unless all or large portions of the sites have been investigated.

Etched shell. No etched shell was found at Cu Achi, but fragments of *Laevicardium elatum* valves that retain traces of an organic resist were found (Fig. 107). When shell is etched, those portions of the design that are not to be affected by the acid (and that will stand in relief afterwards) are coated with a substance that will not react with the acid. In all, eight fragments of cardium shell with traces of resist were found in Excavation Area 1. All of these specimens appear to be pieces from two cardium valves.

Three of the best-preserved fragments (Fig. 107 a-c) were recovered when overburden was being bladed off the southern portion of Excavation Area 1. This blading removed soil to a depth of about 20 inches (50 cm). The largest piece (Fig. 107c) comes from near the shell valve margin where the light concentric sculpture of the shell gives way to the stronger radial ribbing. Which valve (left or right) this specimen comes from cannot be determined. The interior surfaces of all three pieces are recently spalled away, probably by the blader that uncovered them. The resist forms a heavy sort of stairstep-zigzag design, leaving narrow zigzag lines to be etched out on two of the pieces, while the third (Fig. 107a) exhibits what appears to be the design border, with solid triangles completing the zigzag on one side and presenting a straight edge on the other.

Four small fragments (not illustrated) with traces of resist were found from 19.5 to 27 inches (49-67.5 cm) deep in the east extension of Excavation Area 1. Three are thick spalls or flakes from the interior surface of a cardium and have a black-looking coating of resist; no design is discernible. The fourth piece is a fragment of the posterior hinge tooth from the left valve of a cardium. It too retains traces of resist.

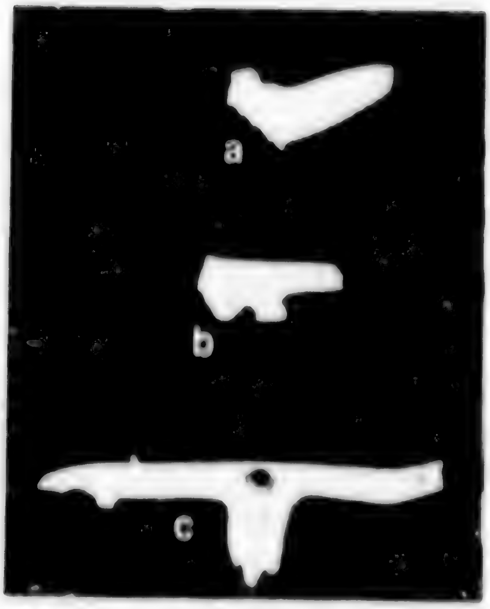

Fig. 106. Cut shell pendants of *Laevicardium elatum*. Length of c, 1.6 cm.

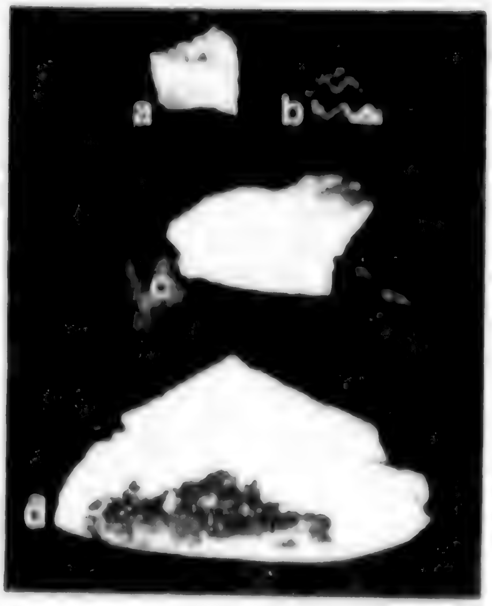

Fig. 107. Fragments of *Laevicardium elatum* coated with resist. Note zigzag design on specimen b. Length of d, 1.8 cm.

The eighth and largest piece of resist-coated cardium (Fig. 107d) was in association with flotation sample #14, taken in the east extension of Excavation Area 1, immediately west of the central pit, at a depth of 31.5 inches. As with the fragment in Figure 107c, this fragment comes from near the valve margin. Enough of this piece remains to show that it is from a left valve. The valve margin itself has been heavily ground down. Part of the interior surface is broken away; hence, this piece and the four pieces described above could be from the same left valve. (Resist coats both the exterior and interior.) No design is discernible on this last fragment, though the resist does extend on to the ground edge of the shell. The resist on this fragment is brownish-black in color, flakes off readily, and gives off a pitchy or gummy odor when submitted to a flame test.

Examples of resist-coated cardium shells have been recorded at the Hodges Site (Kelly and others 1978: 120) and Snaketown (Haury 1976: 318). Further, the author has examined an unreported resist-coated umbonal fragment from the Grewe Site. The resist on all of these specimens appears to be a pitch-like substance.

In his article summarizing information on Hohokam etched shell, Pomeroy (1959) states that although the geographical distribution of etched shell extended almost throughout the known range of Hohokam culture, the temporal distribution was restricted to the time from about A.D. 900 to 1150. All known specimens have been assigned to the Sacaton, Rincon, or Tres Alamos phases, depending on their geographic origin, except for one pendant from Pueblo Grande that is assigned to the Santa Cruz phase (A.D. 700-900). Wasley and Johnson (1965: 45-46) also report an etched *Glycymeris* bracelet fragment from a Sacaton phase site. This is the only non-cardium etched shell known.

The Gu Achi resist-coated shell can be assigned to the late Santa Cruz/Sacaton phase. This accords well with Haury's (1976: 319) statement that etched shell appears to be a purely Sedentary period (Sacaton phase) phenomenon and is an excellent horizon marker.

Worked shell. Ten pieces of worked shell were found (not including one unidentifiable bead, already discussed). One pendant fragment, which may be a reworked bracelet fragment, was found, but it is so ground down that identification of the shell is impossible. Four pieces of worked *L. elatum* were found. One had groove-and-snap cut edges, two had ground edges, and one had a notch ground into it. Four pieces of *Glycymeris* shell with ground edges were found. In addition, one reworked bracelet fragment was excavated from Excavation Area 2. This was ground at both ends to form an awl or a needle without a hole (Fig. 386f).

Unworked shell. The large amount of unworked fragments of *L. elatum* can probably be considered waste from the manufacture of cardium ornaments found at the site. Although whole-valve scoops of *L. elatum* have been found in Classic period sites (Debowski 1974: 165; Urban n.d.), these exhibit use-worn ventral margins. None of the margin fragments from Gu Achi show any other than natural wear. Unmodified whole valves could have been used as pigment containers as at Los Muertos (Haury 1945: 145) and San Cayetano (DiPeso 1956: 81-82), but there are no indications of this use at Gu Achi.

All the unworked specimens of *Pecten vogdesi*, *Argopecten circularis*, *Spondylus calcifer*, *Columbella fuscata*, and the freshwater *Anodonta californiensis* could have been intended for manufacture into ornaments of various types. The land snail specimens, *Succinea* sp., were probably not exploited by man as either a food or raw material source and are probably a natural deposit at the site. A wholly fortuitous occurrence of a *Turritella* sp. shell was also found. This was a small, immature specimen that was wedged behind the hinge tooth of an unworked *L. elatum* valve fragment.

Burned shell. Nine pieces of shell from the Santa Cruz/Sacaton deposits at Gu Achi were thoroughly burned. Most are apparently unworked, but three are fragments of artifacts. All nine pieces have already been discussed under the appropriate heading. They are mentioned separately here because, although no cremations were encountered in the excavations at the site, the burned shell suggests that cremations are probably present, the shell being interpreted here as funerary offerings.

SELLS PHASE

Only four shell specimens were collected from the Sells phase components of Loci LL and MM, but, as with the Snaketown phase material, these indicate strong similarities between shell use patterns at Gu Achi and the patterns in Hohokam "core" areas of the Gila and Salt Rivers for this time period. The specimens collected are presented in Table 36; all are marine species. Observed on survey, but not collected (W. Bruce Masse, Chapter 3 and personal communication), were fragments of *Glycymeris* and *Laevicardium* valves and a single *Olivella* whole shell bead.

The *Dosinia* specimen is an unworked fragment from the ventral margin of the valve. The specimen of *Pteria sterna* (a large nacreous-shelled oyster) from Gu Achi is an unworked fragment from the umbonal area. Utilization of this species appears to have been at its greatest during the late

Dosinia ponderosa Gray	(1)
Pteria sterna Gould	(1)
Melongena patula Broderip and Sowerby	(1)
unidentifiable	(1)

Table 36. Shell species from the Sells phase at Gu Achi.

Sedentary and Classic periods, both in the Papagueria and in the Gila-Salt drainages. Rosenthal and others (1978: 196) record unworked *Pteria* from Classic period sites southwest of Gu Achi. Haury (1976: 308, 312) records *Pteria* nacre shell pendants at Snaketown for the Sedentary period, and Urban (n.d.: 11) records *Pteria* pendants at Las Colinas. Finally, an unworked fragment from the columella and basal portion of a *Melongena patula* shell [illegible] Like *Pteria*, this species apparently was little used but was [illegible] in the late Sedentary and Classic periods. As far as this [illegible] could determine from a literature search, this large univalve (generally about 10 cm long, but sometimes as much as twice that size) has been found in Hohokam sites only in the form of trumpets. Haury (1937b: [illegible], 1945: 159) records this artifact type for Snaketown, age uncertain, and for the Classic period sites of Los Muertos and Las Acequias.

While, because of its fragmentary condition, it is impossible to state whether or not the *M. patula* specimen from Gu Achi was a trumpet, on the strength of the occurrences recorded by Haury (noted above) it seems probable that the Gu Achi specimen either was a trumpet or was collected with the intention that it be made into such an instrument. Only more discoveries of this shell species will clarify whether it was used solely for trumpets and solely during the Classic period.

THE RESERVOIR -- LOCUS A

While the reservoir appears to be Santa Cruz/Sacaton phase in age, there may also be a Sells phase occupation of this locus (Masse, Chapter 3). A Sells phase use of this locus is in fact suggested by the shell material collected there. Six marine shells representing four different species were collected (Table 37). Observed, but not collected on survey, (Masse, Chapter 3) were numerous fragments of *Glycymeris* and *Laevicardium* valves, including bracelets and perforated shells, as well as four *Olivella* whole shell beads. Three additional *Olivella* beads were collected.

The *Trachycardium* specimen is very interesing in that it is apparently a fragment from the band of a bracelet. This bracelet was made by simply grinding flat the top of the valve. No other surface was ground or modified

Trachycardium panamense Sowerby	(1)
Conus perplexus Sowerby	(1)
Olivella dama Wood	(3)$^{+}$
Turritella leucostoma Valenciennes	(1)

Table 37. Shell species from the reservoir at Gu Achi

(Fig. 108a). The size of the ribs on this specimen suggests that the diameter of the complete bracelet could have ranged 5 to 7 cm--the size of a mature *T. panamense* valve. This specimen is unique to the author's knowledge as the only example of a bracelet made from this species of shell. The only other non-*Glycymeris* bracelets known are made from the massive shell of *Dosinia ponderosa* and are a Classic period phenomenon. One is known from the Hodges Site in Tucson (Kelly and others 1978: 116), and Haury (1945: 146) remarks that this species was used "rarely in making bracelets" at Los Muertos. Although Kelly (Kelly and others 1978: 116) indicates that the former is an unfinished object, a personal examination of the specimen shows it to be a completed bracelet, ground on the top and interior. Based on the Classic period age of other non-*Glycymeris* bracelets, it is believed that this *Trachycardium* bracelet fragment is representative of a Sells phase utilization of the reservoir area.

The *Conus perplexus* specimen from this locus is also, apparently, an indicator of Sells phase utilization of the area. This *Conus* shell was made into what is commonly referred to as a tinkler, as the use of this artifact is presumed to have been as an ornament/noisemaker. A tinkler has the entire spire removed from the shoulder up, as opposed to a *Conus* whole shell bead (such as is illustrated in Fig. 108g), which has only enough of the spire tip removed to create a suspension hole. *Conus* tinklers are fairly common finds in Classic period sites, both in the Papagueria and the Gila-Salt drainages, but are extremely rare or absent in pre-Classic sites. Haury (1976: 319) notes that none were found at Snaketown. Again, based on the Classic period age of this artifact in other sites, it is considered to be of that age at Gu Achi.

Three whole shell beads of *Olivella dama* were collected. Lastly, one segment of a *Turritella leucostoma* shell was found that had been "cut" longitudinally, forming a half-cylinder. How it was actually sectioned is unknown. The lateral edges were then ground flat while the interior chamber walls were left unground and in jagged relief (Fig. 105e). Its ornamental use or intended function is unknown.

MISCELLANEOUS SURFACE

One hundred and twenty-seven pieces of shell were collected from the surface of Gu Achi. This, however, was done prior to Masse's recording of the various loci at the site, and hence all are unplaced as to their age. It is likely that most date to the Santa Cruz and Sacaton phases. At least ten marine species are represented, including two unidentifiable large univalves (Table 38).

Bracelets. Only one carved *Glycymeris* bracelet fragment (Fig. 106 b, c) was recovered at Gu Achi, from the surface of the AC Quad. Preservation of the piece is excellent, the shell being white and polished. Carving of the band consisted of alternately grooving the shell band exterior, top and bottom, producing a sinuous outline. The umbo has been carved to suggest a

Glycymeris sp.	(68)
Laevicardium elatum Sowerby	(42)
Pecten vogdesi Arnold	(2)
Argopecten circularis Sowerby	(1)
cf. *Anadara* sp.	(1)
Spondylus calcifer Carpenter	(4)
Conus perplexus Sowerby	(1)
Olivella dama Wood	(2)
unidentifiable	(6)

Table 38. Shell species from miscellaneous surface proveniences at Gu Achi.

a ram's head in frontal view. A very similar treatment of the same is found on a bracelet from the floor of a Sacaton phase pit house at Snaketown (Haury 1937b: Figure 53d; Haury 1976: Figure 16.28b). This is good evidence that the Gu Achi specimen is of Sacaton phase age.

Although only a relatively small portion of Gu Achi was excavated, the large amount of *Glycymeris* shell found in the excavations and the amount still to be found scattered on the surface indicate that the manufacture of shell bracelets probably accounted for a substantial portion of the craft activity carried out at the site. The debitage from bracelet manufacture represents a large percentage of all *Glycymeris* found at the site.

Before discussing the methods employed in bracelet manufacture at Gu Achi, a review of the three known manufacturing methods will be of value. Haury (1976: 306) describes the method used at Snaketown as follows:

> The highest part of the convex surface of a *Glycymeris* valve was worn down on an abrasive surface until a small hole could be punched through it. The diameter of the opening was then expanded by chipping. If the valve wall became too thick for successful chipping, more grinding thinned the shell and provided the edge which made further chipping easy. Roughed out in this way the shell circle could then be finished by reaming and rubbing.

This method was recognized to be distinctly Hohokam as early as 1936 (Woodward 1936: 121). The second known method of bracelet manufacture has been described by both Woodward (1936) and Johnson (1960) for the La Playa site (also known as the Boquillas site), a Trincheras culture site in northern Sonora. As Woodward describes it (1936: 120-121),

> The upper surface of the shell was marked off by deep, regular, short scratches, in which the workman sawed away with his flakes, keeping an even, straight groove. It will be noted that the edges of the cuts are regular and smooth. However, the edges of the underside of the same shells (cores) are rough. Apparently, when the workman had deepened all of the grooves, he simply tapped the center with his hammerstone and it fell out, splintering the underside in the process . . . After the center had been removed, the ragged edges of the crude bracelet were ground down, and the bracelet was smoothed with finer grained stores.

This process consistently leaves the core with a distinctly *grooved* edge (see Woodward 1936: Plate 8, Figure 1, or Johnson 1960: Figure 26c and d). Johnson (1960: 183) noted a *third* process wherein the valve is ground at various points to thin it, and the central core is chipped or punched out, leaving the core with a faceted appearance (Johnson 1960: Figure 26e). Johnson found only three cores made by this process as opposed to 268 cores made by the encircling groove-cut method. Apparently it was not a popular technique at the La Playa site.

Interestingly enough, this third method of initial valve reduction in the manufacture of bracelets, unknown in the Hohokam heartland and unpopular in the Trincheras area, is recorded for three sites in the Papagueria--Ventana Cave, AZ Z:14:21 (near Gu Vo), and Gu Achi. At Ventana Cave Haury noted the presence of five *Glycymeris* "blanks" from the midden, and although he evidently classes them with the more common groove-cut cores from the La Playa site (Haury and others 1950: 368; 1975: 306), the specimen illustrated (Haury and others 1950: Figure 85m) is technologically most similar to cores produced by the grinding-faceted core method. A personal examination showed it to be faceted from grinding and evidently punched or chipped free from the valve, with no ground groove along its margin. AZ Z:14:21 is a transitional Topawa/Sells phase site where two partially ground *Glycymeris* cores were found on the surface (Rosenthal 1977: personal communication, 7/20). Rosenthal (Rosenthal and others 1978: 204) also classes her cores with the encircling groove-cut method, though clearly stating that they are partially ground. The author has not personally examined these two cores. Finally, at Gu Achi, two grinding-faceted cores and two grinding-faceted bracelet blank fragments (Fig. 109) document this method. The cores are from the surfaces of the AC Quad and of Locus F, and the blank fragments are from the surfaces of the AC Quad and of Locus U. Other grinding-faceted specimens were seen on survey, but not collected (Masse Chapter 3).

The total absence in southern Arizona of ground-groove-cut cores and bracelet blanks of the type so popular at the La Playa site indicates this valve reduction technique was never practiced by the Hohokam. The presence, however, of the grinding-faceted core technique in the Papagueria does not preclude the coeval practice in this area of valve reduction such as that

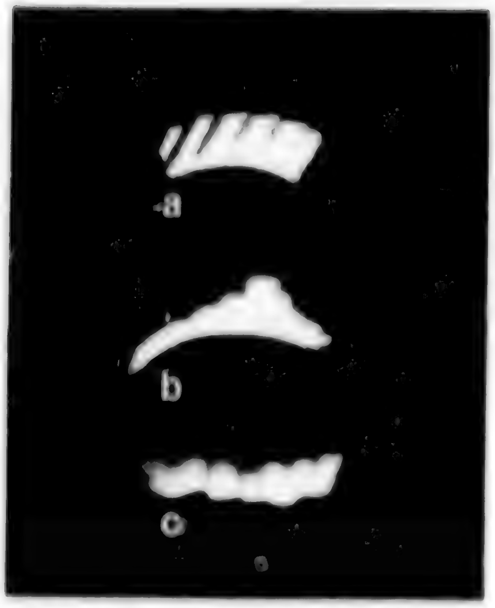

Fig. 108. Unusual shell bracelet fragments: (a) bracelet made from Trachycardium panamense, (b-c) two views of a Glycymeris bracelet. Length of a, 2.5 cm.

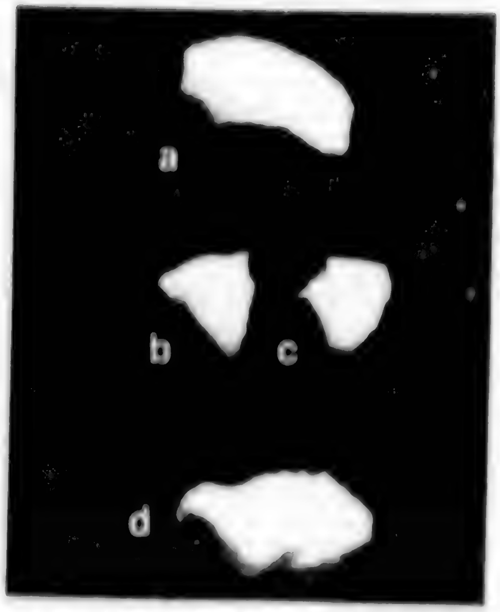

Fig. 109. Debitage from the grinding-faceted technique of bracelet manufacture: (a,d) bracelet blanks, (b,c) cores.

described by Haury for the Gila-Salt River Hohokam. Indeed, the latter stages of all three of these techniques are identical (repeated chipping and grinding) and debitage from the processes would not be distinguishable. Both methods were probably practiced at Gu Achi and throughout the Papagueria.

Finally, there is a question of the relationships, if any, among the three manufacturing methods. Whether the grinding-faceted-core method is an evolutionary intermediate between the Hohokam and Trincheras methods or represents a hybrid of the two is a question that only further work in the Papagueria and Sonora will resolve. At present, the temporal and geographic distributions of the grinding-faceted-core method and the encircling-groove-cut-core method are not known well enough to attempt an answer.

Finger rings. Fragments of six completed finger rings and two unfinished ring blanks were found. All are made of Glycymeris.

Perforated shells. Fragments of three L. elatum perforated shells were found. A fragment of one Argopecten circularis perforated shell was also found (Fig. 105d). Haury (1976: 316) has suggested that perforated pecten shells might have served as finger rings.

Pendants. A fragment of one whole shell pecten pendant and fragments of two notched discs (cog-shaped) of *L. elatum* were found.

Beads. One whole shell bead (pendant?) of *Conus perplexus* was made by grinding off the very tip of the spire to create a suspension hole (Fig. 105g).

Worked shell. One piece of ground *Glycymeris* and five pieces of *L. elatum* with either cut or ground edges were found. In addition, one basically rectangular section of a large univalve wall was found, cut and ground to shape (Fig. 105c). It is 38 mm long and has two conical pits drilled into the interior surface. Possibly it was being made into a pendant.

Unworked shell. As with the Santa Cruz/Sacaton material, the unworked specimens of *Glycymeris* and *L. elatum* are probably waste material from the manufacture of ornaments. The unworked *Pecten vogdesi*, cf. *Anadara* sp., *Spondylus calcifer*, *Olivella dama*, and unidentifiable shell were probably all raw material for the shell working craft. Two of the unidentifiable fragments are from the columellas of two different species of large univalve, one of which could be *Strombus* sp. Neither, however, can be positively identified.

CONCLUSIONS

Because of the presence both of species whose usage by the Hohokam had definite temporal restrictions and of artifact types with temporal significance, the shell recovered at Gu Achi (from both excavated and surface proveniences) serves to (1) reaffirm the age assignments given to the various loci on the basis of their ceramics (such as finding marginally nicked bracelets associated with Snaketown or Gila Butte Red-on-buff, or finding *Pteria* and *Melongena* in Classic period loci), (2) show that, at least in terms of shell work, Gu Achi was closely allied with the Hohokam "core" areas of the Gila and Salt drainages, and (3) demonstrate that shell working was a major activity at the site.

Further, the range of knowledge of shell etching during late Colonial/Sedentary times is extended into the Papagueria, and it appears that the grinding-faceted-core technique of *Glycymeris* bracelet reduction (first described at the La Playa Site in Sonora) may be a technique native to the

Papagueria since (though rare) it occurs most often in this area.

Based on the type of artifacts present and their abundance, it can be inferred that a good deal of time at Gu Achi was spent in the manufacture of shell ornaments, particularly (as far as the sample reported on here suggests) *Glycymeris* shell bracelets, rings, and *Laevicardium elatum* perforated shells. Masse (personal communication), on the basis of his survey at the site, estimated that approximately 1000 pieces of shell still remain on the site surface. The large amount of shell recovered from Excavation Area 1 and its various extensions indicates that in addition to the activities implied by storage facilities and numerous hearths, shell work was very probably being done at or near the ramada.

The occurrence of this Hohokam village, in the Papagueria, with large amounts of shell and shell debitage and predominately red-on-buff decorated pottery immediately suggests that Gu Achi may have served as an important stop along a major Hohokam shell route between the Gila-Salt area and the Gulf of California. Hayden (1972) has documented such Sacaton phase trails in the Ajo and Growler Mountains to the west and posited their existence through the heart of the Papagueria (1972: 79-80). Along with these water holes noted by Hayden (1972) as possible shell expedition stops, Fontana (1965: 65-66) has described the Lost City site (AZ Y:16:1) as having a "super-abundance" of shell items and *Glycymeris* cores. Pottery included Gila Polychrome, Tanque Verde Red-on-brown, and Sacaton Red-on-buff. Although Fontana feels this is a campground used temporarily by shell expeditions, he does note (1965: 66) that there could be pit houses at the site. If so, Lost City could well resemble Gu Achi more than Fontana's description suggests. It is to be regretted that Fontana did not describe the numerous *Glycymeris* cores as this might have shed some light on the integrity of the grinding-faceted-core technique as a regular shell working tradition in the Papagueria. Nevertheless, the people of Gu Achi and, probably, Lost City appear to have been working shell in large amounts and maintaining ties with Hohokam areas to the east and north. For the Santa Cruz/Sacaton age material, this is reflected in the strong similarities between the Gu Achi shell assemblage and that from Snaketown, including knowledge of shell etching. Although the amount of material from the Snaketown component of Gu

Achi is small, the presence of marginally nicked bracelets suggests that (at least as far as shell working is concerned) the inhabitants of Gu Achi maintained ties with the Hohokam east and north of them from the beginning and probably throughout Gu Achi's history. Likewise, the shell species present in the Sells phase material duplicate Classic period assemblages found elsewhere, notably in the presence of Dosinia ponderosa, Pteria sterna, and Melongena patula, whose use is generally restricted to the Classic period. It is felt that more extensive excavation at Gu Achi would probably duplicate the artifacts and species present at Snaketown. As it is, the only difference noted in those traits present at Gu Achi is the technique used in the initial reduction of Glycymeris valves for bracelets.

Finally, there is the question of the cultural identity of the inhabitants of Gu Achi as indicated by their shell work. As stated by Haury in 1950, among the Desert Hohokam shell jewelry was rare and simple (Haury and others 1950: 547). No carving or etching of shell was known (Haury and others 1950: 363-364), and beads were not utilized to any extent (1950: 365). At Ventana Cave, although shell and shell species were abundant, finished items were not. At Valshni Village, very little shell was found in Vamori or Topawa contexts (Withers 1941). At Gu Achi, however, finished ornaments are fairly abundant. While the one carved bracelet may have been imported, it should be remembered that even at Snaketown, carved bracelets constitute only 3 percent of the finished bracelets (Haury 1976: 314). Although possible, it is highly improbable that resist-coated cardium shells were being brought to Gu Achi for the purpose of etching. The problems with using relative abundance of beads for comparative purposes were pointed out earlier. Finally, the use of Trachycardium panamense for a shell bracelet can hardly be considered simple; "innovative" probably describes the situation more accurately. On the basis of the shell at the site, either Gu Achi is not a Desert Hohokam site or the definition of Desert Hohokam must be revised

APPENDIX F

A RADIOCARBON DATE FROM GU ACHI

by
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University of Arizona

One charcoal sample from the prehistoric Hohokam village site of Gu Achi was dated by the Laboratory of Isotope Geochemistry, University of Arizona, under provisions of a cost-sharing agreement with the National Park Service. The analysis was carried out under the supervision of Dr. Paul Damon and Dr. Austin Long. The results of analysis are as follows:

U. of A. Sample No.	W.A.C. Number	Site Number	$\delta^{13}C$(°/oo) P.D.B.	$\delta^{13}C$ Corrected Date B.P.	Dendrochronologically Corrected Date B.P.
A-1819	4	A35C40	-24.2	970 ± 70	950 ± 80 (A.D. 1000 ± 80)

Methodology

Approximately 10 grams of the charcoal were washed in distilled water and chemically pretreated first by heating in 1N HCl (to remove mobile carbonates), then in 2% NaOH (to remove mobile organic acids), and finally in 1N HCl. Water baths followed each chemical solution. After the sample dried, about six grams of it were combusted, and the purified CO_2 was placed in a 2 liter gas proportional counter where its carbon-14 activity was determined by anticoincidence counting. The date was calculated from the average of three 10^3 minute counting periods in statistical agreement. An on-line teletype and INTERCOM terminal to a CDC-6400 computer allowed essentially automatic standard and background referencing and age computations.

Stable carbon isotope measurements ($\delta^{13}C$) of the sample gas were made in order to correct for fractionation differences between the sample and the standard reference gas. This correction added 10 years to the initial age determinations. To correct for variations in the radiocarbon content of the atmosphere over past centuries, the date was converted to solar calendrical years through the use of dendrochronological calibration tables (Damon, Long, and Wallick 1972). This correction subtracted 20 years from the $\delta^{13}C$ corrected age, resulting in the final age.

THREE RADIOCARBON DATES FROM GU ACHI

by
Harold W. Krueger
Krueger Enterprises, Inc.

Three samples of large charcoal fragments from the prehistoric Hohokam village site of Gu Achi were dated by the Geochron Laboratories Division of Krueger Enterprises, Inc. The radiocarbon dates obtained are presented below in Table 39. These dates are based upon the Libby half life (5570 years) for carbon-14, in years before the present (B.P.) expressed with reference to A.D. 1950. The error stated is plus or minus one standard deviation as judged by the analytic data alone. The modern standard for the procedure is 95 percent of the activity of N.B.S. oxalic acid.

The samples of charcoal were excellent and presented no problems in analysis. In processing each sample, the charcoal was first separated from any dirt, rootlets, or other foreign matter. It was then boiled in dilute HCl to remove carbonates and in dilute NaOH to remove humic acids. After washing and drying, it was them combusted to recover carbon dioxide for the analysis.

Sample No.	Location of Sample	Radiocarbon Age
1	Ramada posts, Excavation Area 1	1165 ± 130 years B.P.
2	Hearth 1, Excavation Area 1	1400 ± 125 years B.P.
3	Hearth 1, Excavation Area 2	1190 ± 130 years B.P.

Table 39. The radiocarbon dates from Gu Achi, listed by provenience of sample.

The ages derived from the samples are slightly older than the range expected on the basis of the ceramics (W. Bruce Masse: 1977 letter). It is therefore important to note that dates produced by the carbon-14 method incorporate the age of the specimen at the time of its death, with older specimens providing earlier dates. This is particularly to be considered with respect to Samples 1 and 2 since the charcoal of these samples was in coarse chunks and obviously came from trunks or limbs of substantial size and, apparently, of considerable age.

APPENDIX G

PETROGRAPHIC ANALYSIS OF PREHISTORIC CERAMICS FROM GU ACHI

By
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Department of Geosciences
University of Arizona

INTRODUCTION

This report summarizes the analysis of 25 petrographic thin sections of ceramic sherds, 19 from the prehistoric Hohokam Indian village site of Gu Achi and six comparative specimens from contemporaneous Hohokam settlements in southern Arizona (Table 40). Western Petrographic, Tucson, Arizona, prepared standard petrographic thin sections for this study. Each specimen was impregnated with epoxy, ground in oil, mounted on a glass slide for microscopic study, and stained with a solution of sodium cobaltinitrite to render the potassium feldspar more easily visible.

W. Bruce Masse of the Western Archeological Center requested the following two studies of the 25 specimens: (1) detailed petrographic description of each specimen (Section I, this report) and (2) comparison of selected groupings of specimens to discover any possible relationships within and among these groupings (Section III). The cultural implications of these study results are detailed by Masse (this volume). In addition, a third study, which appears in Section II, grouped all specimens into classes according to the similarity of their temper constituents.

Under study, each specimen was photographed through a microscope with 2.5X objective and 10X ocular lenses, using plane polarized light, to illustrate representative textures and fragment types. Several additional photographs were taken with crossed polarizers and/or higher

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	Specimen #	Pottery Type	Provenience
Gu Achi	1	Schist	Excavation Area 1, occupation surface
	2	Crushed altered andesite(?)	Excavation Area 1, occupation surface
	3	Sells Plain(?)	Excavation Area 1, 12-24"
	4	Crushed altered andesite(?) with schist	Excavation Area 1, 12-24"
	5	Altered andesitic(?) grus	AC Quad
	6	Gila Plain	Excavation Area 1, bell-shaped pit
	7	White schist	Locus MM
	8	Sand (Yuman?)	Excavation Area 4, 0-6"
	9	Schist	Locus D, Collection Area 1
	10	Stucco ware	Excavation Area 1, 0-12"
	11	Snaketown Red-on-buff (sandy)	Locus D, Collection Area 1
	12	Snaketown Red-on-buff (micaceous)	Locus D, Collection Area 4
	13	Transitional Santa Cruz/Sacaton Red-on-buff (micaceous)	Excavation Area 1, occupation surface
	14	Transitional Santa Cruz/Sacaton Red-on-buff (sandy)	Excavation Area 1, occupation surface
	15	Vamori(?) Red-on-brown	Excavation Area 2, 0-12"
	16	Tanque Verde Red-on-brown	Locus Y
	17	Tanque Verde Red-on-brown	Locus A
	18	Rillito Red-on-brown	Locus R
	19	Trincheras Non-specular Purple-on-red	Locus D, Collection Area 6
Comparative Sample	20	Gila Plain	AZ BB:6:9, Alder Wash Ruin,[1] lower San Pedro Valley
	21	Transitional Santa Cruz/Sacaton Red-on-buff	AZ BB:6:9, Alder Wash Ruin,[1] lower San Pedro Valley
	22	Early Sacaton Red-on-buff	AZ U:9:2, Park of Four Waters,[2] Phoenix
	23	Snaketown Red-on-buff	AZ U:9:28, near Park of Four Waters,[2] Phoenix
	24	Late Snaketown Red-on-buff	AZ BB:2:2, Big Ditch Site,[3] lower San Pedro Valley
	25	Transitional Santa Cruz/Sacaton Red-on-buff, Aravaipa Variety	AZ BB:2:2, Big Ditch Site,[3] lower San Pedro Valley

[1] Masse in press a
[2] Masse 1976
[3] Masse in press b, n.d.a, n.d.b

Table 40. Sherds selected for petrographic analysis.

magnification to concentrate on particularly significant features. All photographs, thin-section slides, and the original report have been added to the permanent file of the Western Archeological Center

I. PETROGRAPHIC DESCRIPTIONS

The project proved to be more difficult and time-consuming than anticipated. The petrography of fresh, fine-grained rock fragments was straightforward, but unfortunately many fragments have suffered sericite and saussurite alteration, weathering (perhaps even cooking?), and disaggregation, though overall the fragments were less weathered than expected. Two slides were ground very thin, and some rock fragments were plucked from the slides during preparation, a common problem with altered rocks. In addition, the large grain size of granitic debris and the mixture of rock types in some specimens argue for more thin sections to obtain a representative sample. Usually rock fragments with fine-grained constituents were not much larger than the disaggregated feldspar grains, and it was often difficult to determine if the larger feldspar grains were associated with the fine-grained units in a gneiss or if they originated from a separate plutonic source.

In most specimens, the degree of weathering of constituents is variable, but smaller matrix grains are usually fresher than large fragments. Only feldspars weather significantly; biotite is uncommon. Volcanic debris is usually more weathered and altered than the granitic grus. Overall, the degree of weathering and rounding by transport of feldspars is remarkably slight, suggesting derivation from nearby, rapidly-eroded outcrops, an environment typical of intermittent stream washes and pediment fans. The angularity of some fresh feldspars could be due to crushing, but such fragments are common in natural grus. It is unlikely that the very fresh feldspars observed in many samples could have been associated naturally with the sources of clay.

In the description of each specimen, the percentages of fragments and the grain sizes are rough estimates only. The relative abundance of minerals is usually not reported because few rock fragments are large enough to be representative. Further, phyllite and gneiss refer to grain size rather than to metamorphic grade and could possibly be associated. Optical properties are given whenever the identification of the mineral was uncertain. The descriptions of the specimens emphasize the distinctive features observed; the archeological ceramic "type names" listed below and in Table 40 were designated by W. Bruce Masse.

Specimen 1 (schist)

1. Distinguishing features

   The sample contained angular fragments of fine-grained sericite phyllite and abundant quartzite with low weathering (Fig. 110).

2. Temper:

   Rock fragments and large grains, average size 1.8 mm, constituted 70% of the total specimen.

3. Temper constituents:

   a. Sericite phyllite and quartzite, 100%:

      These are angular-subrounded fragments, elongated up to 4 mm parallel to foliation. The constituents of separate fragments are variable, including up to 90% muscovite, less than 5% golden brown, low 2V(-) biotite (usually altered to chlorite), and small percentages of quartzite, chlorite, and tourmaline. The chlorite is colorless but weathering light brown or stained yellow. The muscovite ranges in size from .3 mm to fine-grained sericite; the coarser muscovite defines foliation. Quartz grains are strained and have a mosaic texture; they range up to .15 mm in size. The tourmaline (elbaite?) has a colorless to green or green-yellow pleochroism, moderate birefringence, and is in the form of prismatic crystals, greater than 1 mm long, with hexagonal cross sections. In some fragments quartz, chlorite, and tourmaline are abundant, but their variable abundance is usually less than 1%. Hematite probably after magnetite forms elongate, ragged grains parallel to the foliation. Plagioclase is present in small grains, few with twinning. Some opaque substances in the specimens may be carbonaceous material.

   b. Separate grains:

      These are subangular grains derived from rock fragments; they average .4 mm in size. Some large plagioclase (biaxiall crystals) give 2V = 90^{0}, [100] on (010) nearly

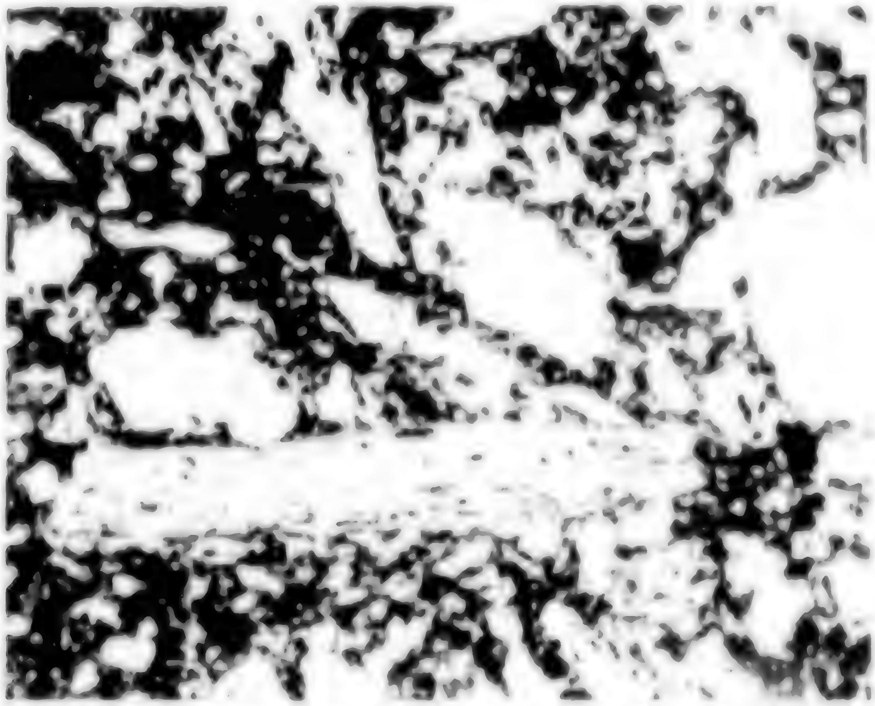

Fig. 110. Microphotograph of Specimen 1 ([illegible]). Note the numerous large fragments of sericite phyllite and quartzite (plane polarized light; scale, 1 cm = [illegible] mm)

parallel); this implies a composition of 20-30% quartzite. One strained grain may be potassium feldspar.

4. Origin:

The angular to subangular character of the fragments, the lack of sorting, and the low weathering suggest that the source of the temper in Specimen 1 was a nearby, fresh outcrop of quartzite-feldspathic phyllite or gneiss with variable abundance of quartzite layers or veins. The low biotite content may be due to metamorphic alteration or weathering; the same may be true of the potassium feldspar. No distinctly granitic component is evident.

Specimen 2 (crushed altered andesite(?))

1. Distinguishing features:

Angular fragments of uniformly fine-grained sericite phyllite and quartzite are mixed with extensively altered and weathered feldspar debris. Abundant dark red-brown clasts (clay?) are distinctive. Epoxy in the fractures indicates that the sherd is in a friable state. This slide is ground thin; the contents are weathered.

2. Temper:

   Temper constitutes 60% of the total, in the form of fragments and large grains (average size, 1.5 mm).

3. Temper constituents:

   a. Altered feldspar, 30%:

      These fragments are mostly weathered to clays (chlorite, sericite?), leaving scattered remnants and some original quartz inclusions. Some grains are completely weathered to a spongy brown material. Magnetite (1-2%) is recognizable.

   b. Fine-grained sericite phyllite and quartzite, 30%:

      The fragments are angular to subangular, elongated up to 2 mm parallel to the foliation. About 40% are uniformly very fine-grained sericite that are usually aligned to produce foliation; the quartz, approximately 30%, is also very fine-grained and is well mixed with the sericite. Plagioclase is also fine-grained, except where it forms microaugen in some fragments. Carbonaceous material is also visible.

   c. Red-banded sherds(?), 20%:

      About 20% of the temper is composed of sherds of an extremely fine-grained unidentifiable material having well-defined banding with variable reddish staining. In polarized light there is some appearance of extinction parallel to the banding. The fragments contain carbonaceous material throughout.

   d. Separate grains:

      Recognizable separate grains are mostly quartzite and potassium feldspar. The feldspar grains are much fresher than those in the fragments. A few zircon grains are also identifiable.

4. Origin:

   The fragments are from a phyllite terrane and probably from an altered plutonic granitic terrane, as the feldspars indicate. The feldspar fragments are too altered to determine the original source rocks of the granitic material. Fresh granitic debris as separate grains suggest that sand from another less weathered source was admixed.

Specimen 5 (Sells Plain(?))

1. Distinguishing features:

   The specimen contains volcanic fragments and probably sericite phyllite. The feldspar exhibits extensive sericite and epidote alteration.

2. Temper:

Rock fragments and large grains (average size, 1.2 mm) constitute 40% of the specimen. Dark red and carbonaceous clasts are distinctive.

3. Temper constituents:

a. Altered feldspar, 70%:

These are subrounded fragments with an alteration matrix of chlorite, clay(?), sericite, and vague remnants of plagioclase grains. Some fragments could be altered andesite. The sericite content is variable and may form a foliation in elongated fragments to resemble phyllite. The plagioclase remnants often appear as many small grains. Scattered magnetite grains are being replaced by red-stained hematite; however, some foliated areas with red staining could be after biotite. Original fragments were mostly plagioclase, formed of grains up to .2 mm in size, with very little quartz.

b. Andesite (latite?), possibly including altered feldspars, 25%:

These are subrounded, altered, and weathered fragments with a porphyritic trachytic texture; approximately 60% are plagioclase laths .2 mm long and fairly well aligned. The approximate plagioclase composition is andesine. Apparently the matrix was originally glass or fine-grained; it is now marked by fine-grained saussurite products, including fine-grained epidote, sericite, and a spongy brown material. In some areas, magnetite altering to hematite forms 10% of the composition.

c. Quartzite, 2%:

The specimen contains one fragment of conglomerate with subrounded quartzite grains .1 mm in size in clay material, and one fragment of mosaic texture quartzite with grains .15 mm in size.

d. Carbonate (caliche?), 3%:

Clasts of fine-grained carbonate greater than .1 mm in size were visible.

e. Separate grains:

The identifiable separate grains are mostly derived from the fragments, including magnetite, but there are a few percent potassium feldspar and carbonate crystals. The plagioclase, subrounded and normally zoned with common Ab twinning, tends to be fresher than in the fragments. Some grains are as large as .5 mm and are only slightly altered. One tourmaline crystal was identified.

4. Origin:

The heterogeneous collection of fragments is derived from altered volcanic and granitic terranes. There is possibly a phyllite component. Sand of granitic origin was also admixed. The extensive alteration and moderate weathering makes it nearly impossible to differentiate the altered feldspars and volcanics.

[illegible] (crushed altered andesite(?) with schist)

1. Distinguishing features:

This specimen is distinguished by angular sericite phyllite fragments and by the spotted appearance of "altered feldspars".

2. Temper:

Rock fragments and large grains comprise about 50% of the specimen. They average 1.5 mm in size.

3. Temper constituents:

a. Altered feldspar(?), 50%:

These subrounded fragments are similar to those of specimen 2. The fragments are composed of remnant plagioclase grains and clots of sericite. In some cases the sericite produces foliation. Up to 60% sericite is present. One fragment is crosscut by a fine-grained quartzite vein. The quartz is usually strained and has a mosaic texture, giving it a phyllite appearance. A few feldspar fragments are extensively weathered.

b. Sericite phyllite and quartzite, 35%:

These fragments are subangular. The quartz is usually fine-grained but ranges up to .3 mm, is strained, and has mosaic texture. Most fragments are more than 50% quartzite and may be pure quartzite. Sericite content ranges from 0 to 60%; magnetite content is less than 1%.

c. Granitic rock or gneiss, 5%:

A small percentage of subangular fragments contain quartz, plagioclase, and potassium feldspar, with average grain size .6 mm. There is some sericite on the edges of fragments. Nearly equal amounts of plagioclase and potassium feldspar suggest a quartz monzonite source (see Fig. 111).

d. Sherds(?), 10%:

The temper also contains a very fine-grained material that can be color-banded (Fig. 112).

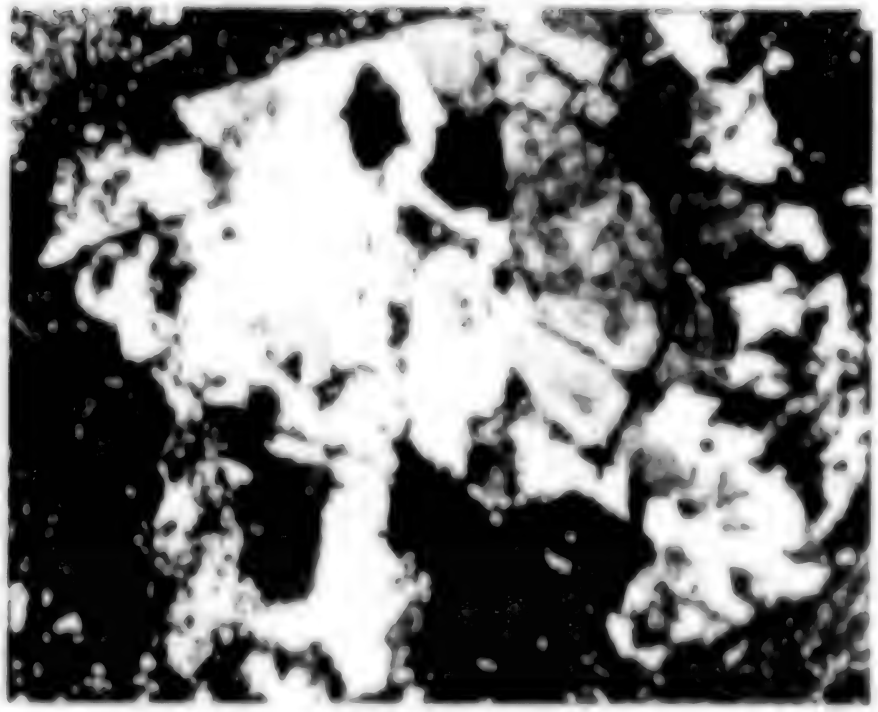

Fig. 161. Microphotograph of gneiss fragment in Specimen 4, crushed altered andesite(?) with schist (crossed polarizers; scale, 1 cm = 2.2 mm).

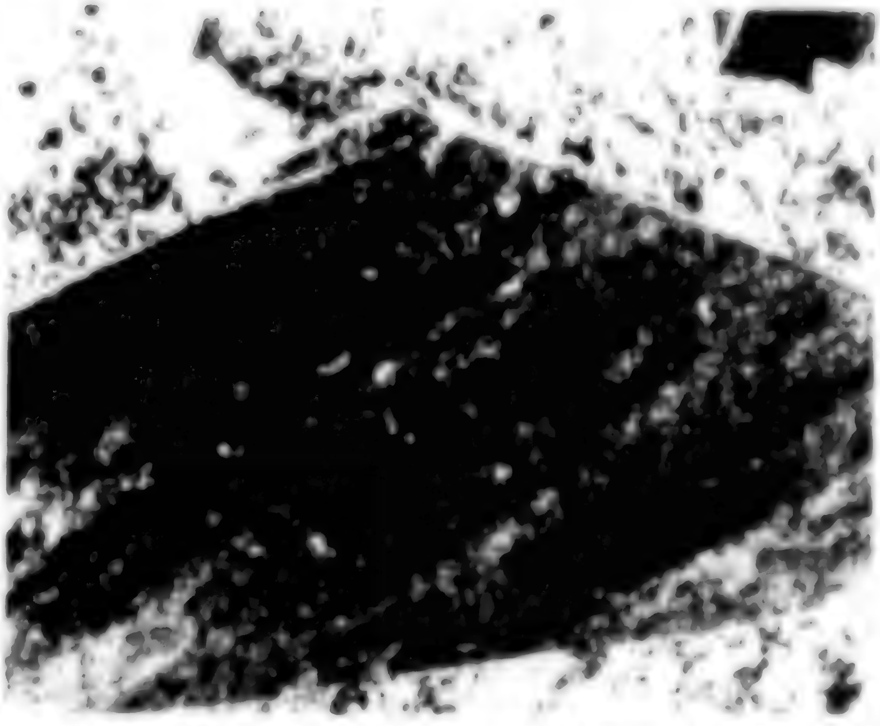

Fig. 162. Microphotograph of clay fragment in Specimen 4, crushed altered andesite(?) with schist (plane polarized light, scale, 1 cm = 2.2 mm).

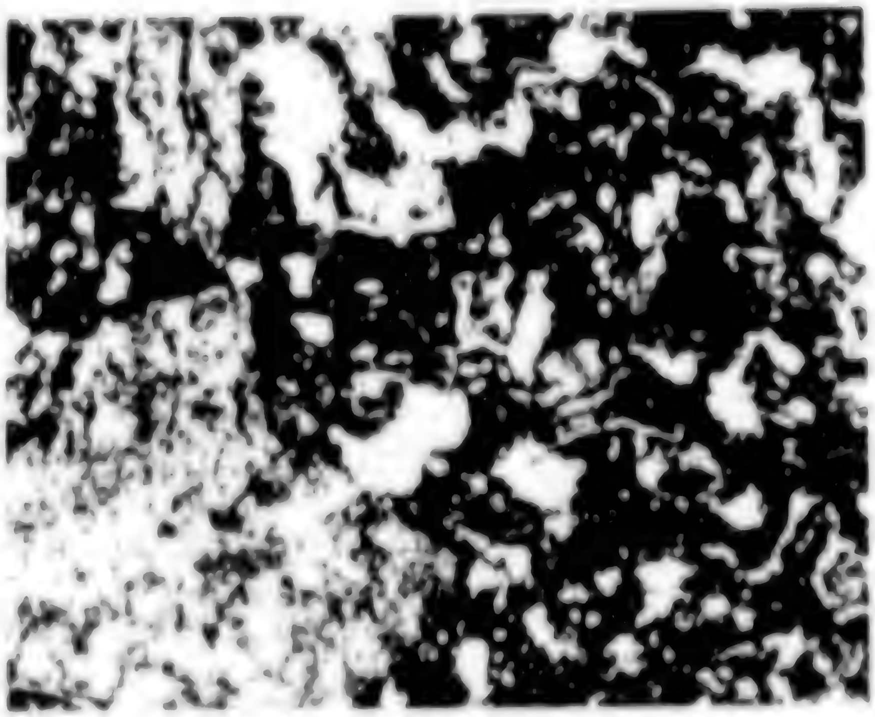

Fig. 115. Microphotograph of Specimen 7 (altered andesitic(?) grog). Note large grain of altered feldspar in lower left corner (plane polarized light; scale, 1 cm = 2.2 mm).

e. Separate grains:
Separate crystals of phyllite components, quartz, plagioclase, and potassium feldspar are visible.

3. Origin:
The sources of the temper constituents are phyllite and granitic terranes, with the possibilities that both may come from a muscovite granitic gneiss and that the "altered feldspar" may be derived from volcanic rock.

Specimen 7 (altered andesitic(?) grog)

1. Distinguishing Features:
The temper of this specimen is composed of a mixture of altering granitic or volcanic debris and sericite phyllite. An opaque substance cements and coats some of the fragments. The sample slide was ground too thin.

2. Temper:
Temper of rock fragments and large grains forms 40% of the specimen (Fig. 115).

3. Temper constituents:

a. Altered feldspar, 80%:

These are subrounded grains about 1 mm in size. Most appear to be single crystals of plagioclase in advanced stages of alteration and weathering to clay products and sericite, but their spotted appearance could result from alteration of microphenocrystic volcanic rock. The tabular shape of some plagioclase crystals may be preserved. Some fragments are enclosed in an opaque casing, possibly of carbonaceous material. Only a few fragments are extensively weathered.

b. Sericite phyllite and quartzite, 10%:

Most of these subangular fragments are phyllite less than 1 mm in size. A number are elongate with foliation defined by sericite. The quartzite fragments also contain sericite and are probably from the same source.

c. Granitic rock, 5%:

These subrounded fragments contain plagioclase, a few potassium feldspar grains, and quartz with a uniform grain size of .3 mm and a plutonic texture. The low potassium feldspar content suggests a granodioritic source.

d. Separate grains:

All separate crystals are derived from the clasts discussed above.

4. Origin:

The origin of the temper in this specimen is a weathered grus derived from granodiorite and some sericite phyllite. The feldspar could be volcanic aggregates now altered. The angular crystals suggest little transport.

Specimen 6 (Gila Plain)

1. Distinguishing features:

Coarse muscovite, epidote alteration, a low potassium feldspar content, and the presence of fresh feldspars characterize the sample. There has been little transport or weathering of the temper.

2. Temper:

Rock fragments and large grains, averaging .8 mm in size, account for 60% of the specimen.

3. Temper constituents:

Muscovite granitic gneiss, 100%:

The constituents of the muscovite granitic gneiss are approximately 70% plagioclase, 20% quartz, 10% muscovite, and traces of potassium feldspar and magnetite. The plagioclase crystals average .3 mm in size, with slight zoning and low to moderate sericite alteration. In a few grains extensive alteration of plagioclase to epidote occurs. The quartz is strained, with mosiac texture. The muscovite, averaging 1 mm in size, has well-formed blades usually intergrown with quartz. Some coarse books of muscovite are found in the matrix. Few but fresh potassium feldspar grains are present, as well as a trace of magnetite with grains up to .15 mm in size. All minerals were observed to be intergrown and constitute a gneiss.

4. Origin:
The rock source for the temper is granitic with muscovite content. The oriented muscovite and strained quartz suggest a gneiss while the low potassium feldspar content suggests an overall granodiorite composition.

Specimen 7 (white schist)

1. Distinguishing features:
Specimen 7 contains angular sericite phyllite fragments, with transition to coarser feldspar crystals as in a gneiss. It exhibits little weathering.

2. Temper:
A temper of rock fragments and large grains, average size .6 mm, forms 40% of the sample.

3. Temper constituents:
    a. Sericite phyllite and quartzite, 80%:
    These are subangular fragments composed of about 70% strained quartz (average grain size, .03 mm), sericite in variable abundance, a light brown chlorite, a trace of apatite, and probably some altered biotite. Unidentified, tiny, colorless crystals were also noted.

    b. Granitic gneiss, 10%:
    A number of subangular fragments, similar to the sericite phyllite and quartzite fragments described above, contain plagioclase and potassium feldspar crystals, up to 2 mm in size, associated with the quartzite. There is low to moderate sericite alteration and low potassium feldspar content.

    c. Carbonate, 10%:
    Several rounded fragments of quartzite have large calcite crystals intergrown.

d. Separate grains:

These are derived from the fragments, mostly feldspar and quartzite but some obvious epidote crystals.

4. Origin:

The source of the temper is probably an augen gneiss terrane of general granodiorite composition with some epidote and sericite alteration.

Specimen 8 (sand (Yuman?))

1. Distinguishing features:

This specimen contains extensively altered "feldspars". Muscovite and potassium feldspar are rare. The specimen is ground thin.

2. Temper:

Rock fragments and large grains, averaging .5 mm in size, make up 60% of the specimen.

3. Temper constituents:

a. Altered feldspar, 99%:

These are subrounded grains with a spotted appearance from remnant plagioclase regions. Originally they were probably mostly plagioclase, but extensive alteration to sericite and epidote (saussurite alteration) makes identification impossible. At least one grain shows a trachytic texture of feldspar crystals characteristic of andesitic (latite?) volcanic rocks. Some fragments are elongated and have enough sericite to resemble phyllite, but there is little quartzite like that in the phyllite.

b. Quartzite, 1%:

Only two fine-grained fragments were observed.

c. Separate grains:

Of the separate crystals, about 30% were quartz, and 70% were altered feldspar. A few potassium feldspar grains, a few scattered grains of magnetite and extremely fresh feldspar, and a trace of zircon(?) were identified.

4. Origin:

The source of the temper may be either a well-altered granitic or volcanic source though the absence of coarse muscovite and the low quartzite content suggest a volcanic source. Fresh sand derived from a granitic source was mixed with the weathered and altered fragments.

Specimen 9 (schist)

1. Distinguishing features:
   Angular fragments of sericite phyllite and abundant quartzite characterize this specimen. In its overall aspect, the sample is nearly identical to specimen 1. The angular to subrounded character of the fragments and crystals indicates little transport or weathering.

2. Temper:
   Temper of rock fragments and large grains, average size 1 mm, constitutes 70% of the sample.

3. Temper constituents:
   a. Sericite phyllite and quortzite:
      Fragments of up to 100% sericite, fairly well aligned, account for most of the temper. The remainder of constituents are predominantly quartz with some albite but include several percent magnetite altering to hematite, an olive green/green tourmaline, some chlorite, and possibly some carbonaceous material. The chlorite has very low birefringence, is grey under crossed polarizers, and has a very low 2V(-). The quartzite has an average grain size of .15 mm, but several crystals ranged up to 1.5 mm. Often the quartzite is strained and has mosaic texture.

   b. Carbonate:
      There was one clast of carbonate, probably caliche, in the sample.

   c. Separate grains:
      These included the large crystals of quartzite mentioned above, grains of feldspar--both with low alteration--and one zircon crystal. Several feldspars have cross-hatched twinning characteristic of microcline.

4. Origin:
   The source of the temper is a muscovite-bearing gneiss that may have potassium feldspar segregated in layers.

Specimen 10 (stucco ware)

1. Distinguishing features:
   The temper of this specimen has the characteristic trachytic texture of andesite. The spotted altered feldspars may also be indicative of andesite. The specimen is marked by extensive weathering.

2. Temper:

Rock fragments and large grains, averaging 1 mm in size, constitute approximately 50% of the specimen.

3. Temper constituents:

a. Andesite (latite), 80%:

Microphenocrystic, euhedral plagioclase (ranging up to .15 mm in size), is identified by extinction angle as andesine in composition. Sixty percent of the interstitial material is now altered to unidentifiable products (fine-grained epidote, sericite) and 10% is opaque. Most fragments are well altered and weathered but retain a characteristic trachytic texture.

b. Altered feldspars(?), 15%;

Subrounded fragments, mostly clays after feldspar or andesite fragments, form approximately 15% of the temper. Some feldspars were probably large crystals of granitic derivation, greater than 1 mm in size.

c. Quartzite, 5%:

A small percentage of the sample consists of subrounded fragments of fine-grained quartz with clay alteration of other minerals (feldspars?).

d. Separate grains:

Approximately half of the separate crystals are altered plagioclase. Another 30% are quartz, and the remainder are potassium feldspar, zircon, and magnetite.

4. Origin:

The source of this temper was predominantly weathered andesite; however, the single grains of potassium feldspar and zircon are evidence that rock from a granitic source was also included.

Specimen 11 (Snaketown Red-on-buff (sandy)

1. Distinguishing features:

The specimen has a low content of muscovite and potassium feldspar. It is marked by a granitic texture and includes fresh, zoned plagioclase. It exhibits little weathering.

2. Temper:

Temper of rock fragments and large grains (average size, .6 mm) constitute 40% of the specimen.

3. Temper constituents:

a. Granitic gneiss or plutonic rock and quartzite, 100%.

Most of these subrounded fragments, averaging .3 mm in size, contain subhedral, normally-zoned plagioclase with some sericite alteration but usually little weathering. Fine-grained quartzite with mosaic texture is associated with feldspar. Sericite is associated with the quartzite, and a few larger blades are present as loose grains, but sericite is less abundant than in sericite phyllite or muscovite granitic gneiss. Several potassium feldspar crystals occur with the plagioclase.

b. Separate grains:

Most of the separate crystals are plagioclase, quartz, and potassium feldspar. Several books of muscovite are also present. The single crystals show only low to moderate alteration and little weathering.

4. Origin:

The source for both fragments and matrix grains was a fresh plutonic or coarse gneissic granodiorite. The muscovite probably come from "pegmatitic" segregations common in such rocks. The lack of deformation of the plagioclase and the subhedral, zoned character of the feldspars, together with the low muscovite content, suggest limited metamorphism; the subangular fragments indicate little transport.

Specimen 12 (Snaketown Red-on-buff (micaceous))

1. Distinguishing features:

The specimen contains fresh feldspars, quartzite, coarse muscovite, and a small amount of potassium feldspar.

2. Temper:

Rock fragments and large grains, averaging .3 mm in size, account for 40% of the specimen.

3. Temper constituents:

a. Muscovite granitic gneiss, 100%:

Quartz crystals, strained and with mosaic texture, range from .03 to .3 mm in size. The associated muscovite is coarser grained than sericite (up to 1 mm). The plagioclase shows abundant albite twinning but little zoning. Alteration and weathering of the plagioclase is generally low, but there are a few extensively altered and weathered grains. Magnetite with grains up to 0.1 mm in size were noted, along with chloritized biotite, a trace of apatite, and tourmaline.

b. Separate grains:

Most of the separate grains are quartz and fresh plagioclase, but there are some muscovite books, about 2% magnetite, and a trace of zircon (in rounded grains).

Potassium feldspar and tourmaline are rare. Some of the larger feldspars have suffered advanced weathering.

4. Origin:
The temper source is a muscovite granitic gneiss terrane of general granodiorite composition, perhaps with muscovite segregations. It is a fresh outcrop that has suffered little weathering.

Specimen 13 (Transitional Santa Cruz/Sacaton Red-on-buff (micaceous))

1. Distinguishing features:
This sample is similar to Specimen 12, with the addition of a few red fragments. The sample contains coarse muscovite, fresh feldspars, and few potassium feldspars. In preparation, many fragments had been plucked from the slide.

2. Temper:
Temper constitutes 40% of the sample in the form of rock fragments and large crystals averaging 1 mm in size (Fig. [illegible]).

3. Temper constituents:
   a. Muscovite granitic gneiss, 95%:
      The components of the fragments are the following: subhedral, zoned plagioclase (average size, .5 mm); strained quartz with mosaic texture (varying from fine grained to .5 mm); rare fine-grained potassium feldspar (low content); muscovite (as large as .7 mm and accounting for 30% of some fragments); and needles and larger grains of apatite. Sericite and chlorite alteration of the feldspars is usually at an early stage, but some grains are extensively altered.

   b. Dark red clay(?) clasts, 5%:
      Nearly opaque clasts with a deep red color form a small part of the temper.

   c. Separate grains:
      Nearly 50% of the separate grains are muscovite blades; the remainder are plagioclase, quartz, potassium feldspar, and possibly some oxidized biotite.

4. Origin:
The source of the temper is a muscovite granodiorite gneiss with little weathering or transport.

Specimen 14 (Transitional Santa Cruz/Sacaton Red-on-buff (sandy))

1. Distinguishing features:
Muscovite and potassium feldspar are common in this sample, which also contains a few fragments of fine-grained quartzite

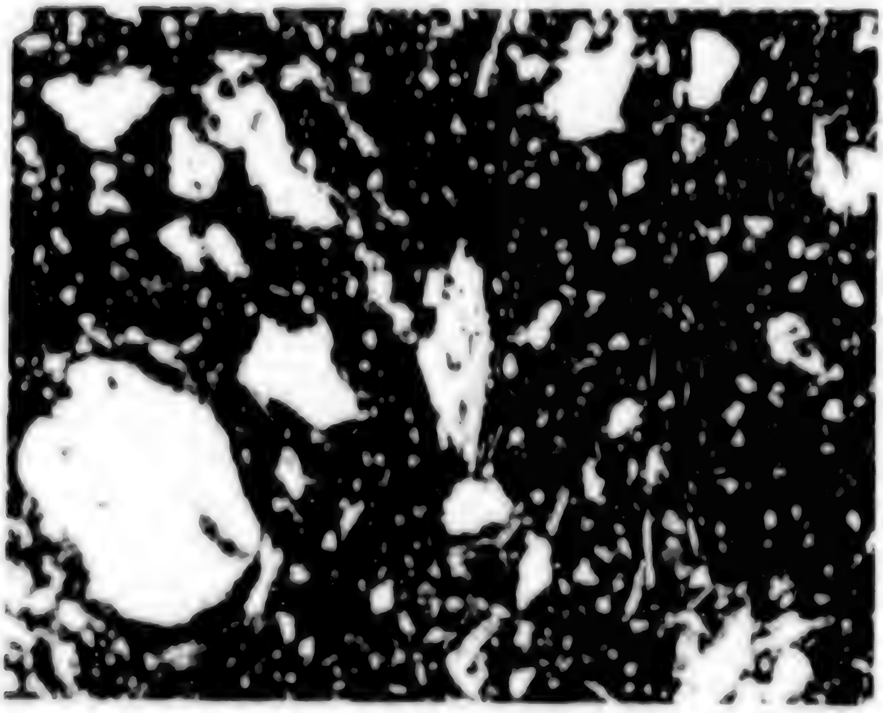

Fig. 114. Microphotograph of Specimen 13 (transitional Santa Cruz/Sacaton Red-on-buff, micaceous). Note the size and numbers of fragments and compare with Figure 115 (plane polarized light; scale, 1 cm = 2.2 mm).

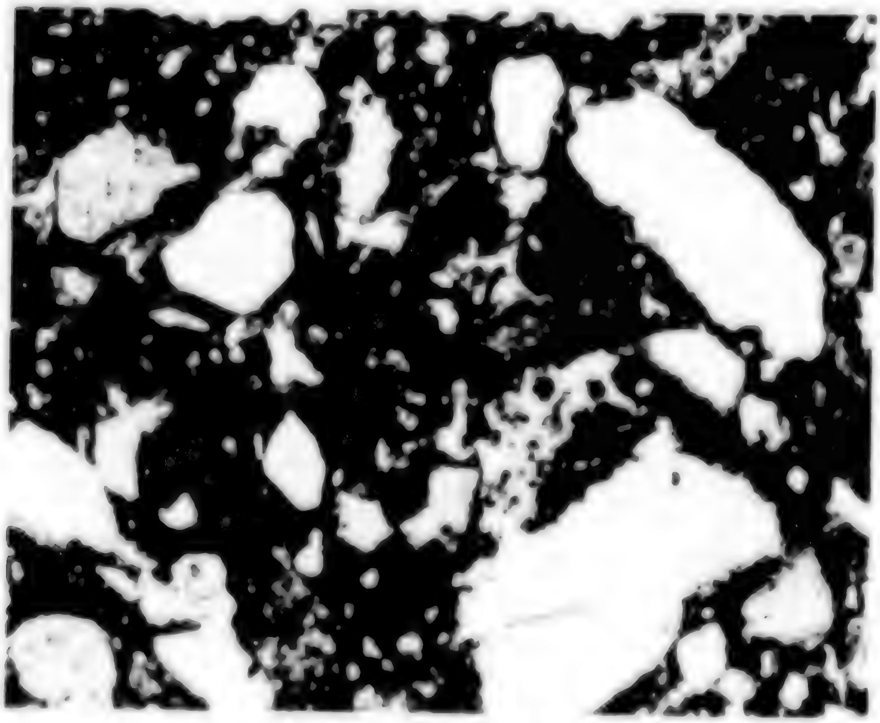

Fig. 115. Microphotograph of Specimen 14 (transitional Santa Cruz/Sacaton Red-on-buff, sandy). Compare with Figure 114 (plane polarized light; scale, 1 cm. = 2.2 mm).

and large epidote grains. The temper exhibits low to moderate weathering. The appearance of the slide (Fig. 115) is similar to that of specimens 12 and 13, but the fragments are coarser-grained and there are more reddish clasts in this sample (compare with Fig. 114).

2. Temper:

This temper, forming 60% of the specimen, consists of rock fragments and large grains of average size, 1 mm.

3. Temper constituents:

a. Muscovite granitic gneiss, 75%:

The fragments are subrounded. Overall, their composition is 80% plagioclase with subordinate quartz and potassium feldspar. Nonetheless, muscovite or sericite may constitute up to 50% of some fragments, and one fragment has 50% apatite. Most plagioclase show some zoning and twinning but little strain; one crystal was 2 mm long and unstrained, implying little deformation. Epidote, which tends to form large crystals, is replacing plagioclase in some fragments. The quartz is strained, mosaic in texture, and some grains are as large as .5 mm. The potassium feldspar is mostly altered. There are some large grains, commonly with cross-hatched twinning that indicates microcline. There is some sericite alteration of feldspar.

b. Altered feldspar(?), 15%:

These fragments have suffered extensive sericite and clay alteration.

c. Andesite (latite?), 5%:

Zoned, euhedral plagioclase laths (average length, .1 mm), form a small percentage of the fragments. A few are highly weathered.

d. Clay fragments, 5%:

These are deep red and nearly opaque.

e. Separate grains:

Most of the separate grains are plagioclase, quartz, and potassium feldspar from gneiss. There are several crystals as large as .3 mm that have moderate to high birefringence. These are probably epidote with magnetite inclusions; they have inclined extinction, moderate 2V(+), moderate positive relief, and a slightly pink to colorless pleochroism on the maximum birefringence section. One grain of garnet(?) and a few of zircon were also observed.

4. Origin:

The temper source is a granodiorite plutonic or gneiss terrane that has undergone some weathering and some alteration to muscovite and epidote. It probably once contained a small percentage of biotite that is now extensively altered. Some grains are well-rounded, implying significant transport. The identification of weathered feldspar and andesite debris is uncertain.

Specimen 15 (Vamori(?) Red-on-brown)

1. Distinguishing features:

Potassium feldspar crystals, many of them large, are abundant in this sample. Further, no muscovite, little sericite alteration, and very little fine-grained quartzite were noted.

2. Temper:

About 30% of the sample is temper--rock fragments and large grains of variable size, but average size is less than 1 mm.

3. Temper constituents:

a. Granitic plutonic fragments, 100%:

The fragments vary in size from fine-grained to 4 mm subrounded fragments. Some potassium feldspar grains are greater than 2 mm but many are finer. There are a number of large plagioclase and quartz grains, and a small amount of fine-grained quartzite. Several subangular fragments of zircon are present. Some of the plagioclase is normally zoned. There is no real evidence of deformation or metamorphism. Possibly a few grains are seriticized and chloritized biotite. Clay, sericite, and clinozoisite (epidote?) alteration of feldspar is common.

b. Separate grains:

Most separate grains are debris from the fragments. About half of them are quartz, plus plagioclase and potassium feldspar. There are a number of conspicuous zircon grains, and about 1% of the crystals is magnetite altering to hematite. Possibly there are a few epidote and biotite grains, but they are stained and altered.

4. Origin:

The source of this temper is a light to moderately weathered quartz monzonite or granodiorite terrane that shows less hydrothermal alteration than the previous samples.

Specimen 16 (Tanque Verde Red-on-brown)

1. Distinguishing features:
   Large potassium feldspar crystals are common. The sample lacks epidote, sericite, and quartzite and exhibits low weathering and alteration.

2. Temper:
   Temper fragments and large grains from granitic plutonic rock (average size, .7 mm) account for about half of the specimen.

3, Temper constituents:
   a. Granitic plutonic rock, 100% (5% fragments; remainder as separate grains):
      The total composition is quartz and plagioclase. Quartz crystals average .3 mm in size, coarser than in phyllite or gneissic quartzite. They are strained and have ragged boundaries.

   b. Separate grains:
      Most of the clasts consist of subrounded, single crystals, as follows: 70% plagioclase, 20% quartz, and 10% potassium feldspar, all occurring in grains greater than 1 mm in size. The plagioclase is commonly normally zoned, twinned (albite), and deformed little. One percent zircon is conspicuous, as is a trace of fine-grained magnetite. There are a few well-weathered feldspars, but most show only incipient clay weathering and no sericite alteration.

4. Origin:
   The origin of the temper is a fresh quartz monzonite source that shows little alteration, weathering, or transport.

Specimen 17 (Tanque Verde Red-on-brown)

1. Distinguishing features:
   The specimen contains large potassium feldspar and plagioclase crystals that show moderate weathering but little sericite and epidote alteration.

2. Temper:
   Temper forms 60% of the specimen; most consists of single crystals, but several fragments are included.

3. Temper constituents:
   a. Two clasts contain mosaic-textured quartz and plagioclase.

   b. Several caliche fragments include quartz, plagioclase, and potassium feldspar grains.

c. Several trachytic andesite fragments were found.

d. Separate grains:
Nearly the entire temper is separate grains of the following: plagioclase (50%), quartz (40%), and potassium feldspar (10%). Their diameters range up to 1.5 mm; however, the plagioclase and potassium feldspar crystals tend to be larger than the quartz. The plagioclase has little zoning, but albite twinning is common. Weathering of the feldspars is low to moderate, with the potassium feldspar usually more weathered than the plagioclase. Zircon, highly altered biotite, a few small epidote crystals, and less than 1% magnetite altering to hematite are also present.

4. Origin:
Subrounded to rounded grains indicate that the source of this sample is a quartz monzonite that has suffered slightly more weathering and transport than that of the previous samples. Some epidote indicates alteration but not as much as most samples; epidote is sporadic but common in granitic terranes.

Specimen 18 (Rillito Red-on-brown)

1. Distinguishing features:
Specimen 18 contains large feldspar crystals (especially potassium feldspar) that show moderate to heavy weathering. It has a low sericite content.

2. Temper:
Large crystals and several rock fragments of average size .4 mm form 50% of the sample.

3. Temper constituents:
a. Granitic rock:
Only several fragments show intergrowth of large feldspars and quartz in a typical plutonic texture.

b. Separate grains:
As in several previous samples, granitic grus with subrounded to rounded crystals of fairly uniform size constitute the greatest part of the temper. About 40% of the separate grains are quartz, and 60% are altered and weathered feldspars. There is nearly twice as much plagioclase as potassium feldspar. Most feldspars are moderately to completely weathered to clay with a trace of sericite. There are a few fresh plagioclase grains with albite twinning.

4. Origin:
The temper comes from a moderately to extensively weathered granodiorite source with little hydrothermal alteration.

Specimen 19 (Trincheras Non-specular Purple-on-red)

1. Distinguishing features:
Large potassium feldspar crystals are common in this specimen. It contains very little sericite and shows little weathering.

2. Temper:
About 60% of the sample consists of fragments and separate grains of granitic plutonic rock.

3. Temper constituents:
   a. Granitic plutonic rock, 100%:
   Most of the temper is formed of subangular to subrounded fragments of quartz monzonite and derived quartzite with light to moderate sericite alteration of plagioclase. Additional contents of fragments are strained quartz ranging in size from fine to coarse; about 15% potassium feldspar, some of it large crystals; about 2% magnetite; and some plagioclase with extinction angles 12° to 20°, implying either oligoclase or andesine.

   b. Separate grains:
   All are derived from the clasts described above.

4. Origin:
The source of the temper is a quartz monzonite terrane with low alteration and weathering.

Specimen 20 (Gila Plain)

1. Distinguishing features:
This specimen contains coarse feldspars, abundant potassium feldspars, and coarse muscovite and epidote in limited quantities. The sample contents show low to moderate weathering.

2. Temper:
Large grains and fragments of granitic plutonic rock constitute 40% of the specimen.

3. Temper constituents:
Granitic plutonic rock, 100%:
All the subrounded fragments and separate crystals come from the same source. Plagioclase comprises about 50%; quartz, 30%; and potassium feldspar, 15%; the remainder of the temper contents are epidote, sericite, and opaques. There is moderate sericite alteration of the plagioclase, but overall there is low to moderate weathering.

Some of the large potassium feldspar crystals are greater than 3 mm, similar in size to the plagioclase. The sample contains only a few percent muscovite and less than 1% epidote. Some of the epidote crystals are well formed, however, and there are some large blades of muscovite (up to 3 mm in size) loose in the matrix.

4. Origin:
The temper originated in a quartz monzonite or granodiorite terrane with some coarse muscovite and epidote alteration and low to moderate weathering.

Specimen 21 (transitional Santa Cruz/Sacaton Red-on-buff)

1. Distinguishing features:
The sample is tempered with muscovite contained in gneiss and has low contents of potassium feldspar and epidote.

2. Temper:
Rock fragments and large grains, averaging .4 mm in size, constitute about 40% of the specimen.

3. Temper constituents:
   a. Granitic gneiss, fragments and separate grains, 99%:
      The granitic gneiss is composed of the following: about 60% quartz; 30% plagioclase, smaller quantities of muscovite, a few small potassium feldspar grains, less than 1% magnetite, and a trace of epidote. Some of the plagioclase is well-zoned, and most has suffered low to moderate weathering. Muscovite (up to 2 mm in size) is common in quartz-rich areas and in sericite masses of aligned crystals. A number of brown-stained areas have formed possibly after biotite, and several extensively weathered clasts are probably after feldspar. The average grain size of the quartz-rich fragments is less than .1 mm.

   b. Andesite, 1%:
      One fragment has the texture characteristic of andesite.

4. Origin:
The source of the temper is a granodiorite gneiss.

Specimen 22 (early Sacaton Red-on-buff)

1. Distinguishing features:
The sample contains temper characterized by sericite-altered, zoned plagioclase and a few large potassium feldspar grains.

2. Temper:

Temper, mostly separate grains averaging .4 mm in size, accounts for 30% of the specimen.

3. Temper constituents:

a. Granitic plutonic or gneiss rock, fragments and separate crystals, 60%:

Most of this is zoned, subhedral to anhedral plagioclase with some sericite alteration in the interior and interstitial quartz concentrations that may include some coarse muscovite (though most of the muscovite is so small). There is a 1 to 3% content of potassium feldspar, some grains of which are as large as 2 mm, and about a 1% content of magnetite. It is possible that the source of this temper could be a gneiss, but it is lower in muscovite than the muscovite gneiss in other samples.

b. Altered and weathered feldspar, 20%:

Completely seriticized and weathered outlines of crystals are visible; the zonal pattern of alteration suggests that they are after zoned plagioclase.

c. Muscovite gneiss, 5%:

A small part of the temper is fine- to medium-grained quartzite having angular fragment outlines and containing aligned muscovite. Possibly the muscovite gneiss may grade into the plutonic rock described above. This rock is abnormally low in muscovite for a gneiss.

d. Clay(?), 15%:

A number of red-brown clay clasts, some with fine-grained quartz inclusions, are visible in the sample.

e. Separate grains:

These are fragment-derived and include a few large potassium feldspar crystals.

4. Origin:

The temper is derived from a granodiorite gneiss and possibly from a plutonic terrane.

Specimen 23 (Snaketown Red-on-buff)

1. Distinguishing features:

This specimen contains medium- to coarse-grained muscovite and quartzite; it has a low potassium feldspar content.

2. Temper:

Rock fragments, averaging .4 mm in size, constitute 30% of the sample.

3. Temper constituents:

a. Muscovite gneiss, 100%:

Most fragments are muscovite-bearing quartzite made up of grains as large as .5 mm in size, but there are some muscovite clots and large muscovite blades in the matrix. The fragments are similar to the sericite phyllite and quartzite except that the muscovite and quartz are coarser-grained and the fragments lack the characteristic angular outline. Also, the fragments of this sample contain more plagioclase crystals than sericite phyllite or quartzite. A trace of green-yellow tourmaline and a few grains of epidote were noted.

b. Separate grains:

A few, large, subrounded grains of plagioclase and potassium feldspar suggest a gneiss or plutonic source.

4. Origin:

The source of this temper is a muscovite gneiss of general granodiorite composition.

Specimen 21 (late Snaketown Red-on-buff)

1. Distinguishing features:

This sample contains coarse-grained muscovite in quartzite and a small amount of potassium feldspar.

2. Temper:

Fragments and large grains, averaging .5 mm but variable in size, account for approximately 50% of the specimen.

3. Temper constituents:

a. Muscovite granitic gneiss, 80%:

These are subangular fragments primarily composed of muscovite and quartzite, with small amounts of other minerals. The muscovite generally measure less than 1 mm and include some sericite clots. The average grain size of the quartzite is .1 mm. Additional contents are the following: 1% plagioclase, less than 1 mm in size; several potassium feldspar grains, less than .5 mm with microcline twinning; about 2% biotite; less than 1% magnetite, with some grains as large as .3 mm; and a green to colorless pleochroic tourmaline.

b. Altered feldspar, 20%:

Clasts with extensive sericite alteration and clay weathering products make up about a fifth of the temper.

4. Origin:

The temper is from a muscovite granodiorite gneiss.

Specimen 25 (transitional Santa Cruz/Sacaton Red-on-buff, Aravaipa Variety)

1. Distinguishing features:
   This sample contains fine-grained, laminar sericite phyllite and a small quantity of coarse epidote; it lacks coarse muscovite and quartzite.

2. Temper:
   Temper of rock fragments and large grains (average size [illegible] mm) constitutes 50% of this specimen.

3. Temper constituents:
   a. Fine-grained sericite phyllite, 40%:
      These are subangular sericite and fine-grained quartzite fragments, averaging .01 mm in grain size. Sericite content and alignment are variable. There are a trace of tourmaline and about 1% magnetite. The fine, uniform banding of sericite and quartz is more regular than in other samples.

   b. Granitic gneiss and separate grains, 10%:
      The granitic gneiss content is in the form of subrounded fragments and separate crystals. Several grains of plagioclase, quartz, and potassium feldspar (which is rare) reach 2 mm in size. The plagioclase is generally altered little, but some plagioclase is preferentially altered to sericite in the center. Sericite is present only as an alteration product of feldspar. Several large grains of epidote (greater than 1 mm) are associated with the plagioclase. There is no coarse muscovite as in the muscovite gneiss.

   c. Andesite:
      Two small fragments of andesite, rounded and weathered, were noted.

4. Origin:
   The source of the temper is a fine-grained sericite phyllite (with some sericite-altered granodiorite) that has experienced little weathering.

II. PETROGRAPHIC CLASSIFICATION

On the basis of their petrographic characteristics, eight categories were tentatively established for the 25 specimens. The salient features that define each category are discussed, a number of possible exceptions are noted, and, finally, several possible supergroups of categories are suggested.

	Specimens	Characteristics
A.	1, 9	Both specimens contain abundant angular fragments of quartzite and sericite phyllite, often with opaques strung along foliation planes. The average size of quartz grains is .15 mm. The specimens have a low feldspar content.
B.	2, 3, 4, 5	These specimens contain heavily altered feldspar crystals that have a spotty appearance from feldspar remnants (Some of these crystals may be weathered andesite fragments.), some angular sericite phyllite fragments, a little quartzite, and possibly some clay sherds(?). Specimen 3 definitely contains andesite fragments.
C.	10	This specimen contains altered trachytic andesite or latite.
D.	8, 12, 13, 14, 21, 23, 24	All specimens contain abundant muscovite-bearing quartzite. Both the muscovite and quartz are slightly coarser than in the phyllite in Group A but otherwise have a similar texture. The specimens may be part of a textural series that also includes samples with common plagioclase and uncommon potassium feldspars (in crystals over 1 mm in size), suggesting a granitic gneiss origin for the series. Separate muscovite blades or books occur in the clay matrix. This group of specimens exhibits only incipient sericite alteration of feldspar. Specimen 14 contains altered andesite debris.
E.	11, 22	As in the specimens grouped in D above, quartzite is common in these samples. It may grade to gneiss, with subhedral, zoned plagioclase and a few percent potassium feldspar (both .5 mm in size). However, sericite is present only as a minor alteration of feldspar and rarely as blades in the matrix.

F.	20	Again, this specimen is similar to those of group D, but here potassium feldspar is nearly as abundant as plagioclase.
G.	15, 16, 17, 18, 19	These specimens contain a temper of coarse quartz monzonite grus without fine-grained quartzite. Sericite is found only as the result of low to moderate alteration of feldspar. Potassium feldspar is nearly as abundant as plagioclase. Specimens 15, 17, and 19 contain andesite debris.
H.	25	The temper of this sample is a fine grained, [illegible] laminated sericite phyllite mixed with [illegible] granitic gneiss or plutonic rock.

Exceptions

Specimen 7 clearly belongs to Group A by the abundant sericite phyllite and quartzite, but it also contains feldspars, similar to those in Group D, in association with the quartzite indicating a granitic gneiss source. It is possible that groups A and C could have the same source as the muscovite granitic gneiss.

Specimen 8 probably belongs in group B, but it is finer grained, and the feldspars it contains are more weathered.

Supergroups

The major petrographic distinction that has genetic significance and seems to adequately differentiate samples is the presence or absence of muscovite (sericite), which appears to be quite resistant to weathering, associated with quartzite. On this basis, group C can be separated from all the other groups.

The distinction, because of the nature of temper contents, among groups D, E, and F is particularly tenuous. Further, it is possible that the sericite phyllite and muscovite granitic gneiss of groups

A, D, E, F, H, and of specimen 7 could have the same source since the distinction made here has been based on grain size and does not imply different metamorphic grades. In addition, the volcanic fragments in groups B, C, D, G, and in specimen 8 could have the same source.

III. COMPARISON CATEGORIES

In the following discussion, samples of ceramics from Gu Achi are compared petrographically to six specimens from other contemporaneous Hohokam sites. Ceramic "types names" of the specimens are listed in respective order after the specimen numbers. The cultural implications of these comparisons are discussed by W. Bruce Masse (this volume).

Specimens 1, 6, 7, 9, 20 (schist, Gila Plain, white schist, schist, Gila Plain)

Specimens 1 and 9 are nearly identical. Specimen 7 was derived predominately from the same source but also shows the gneissic character of specimen 6. The "sericite phyllite and quartzite" of group A and the "muscovite granitic gneiss" of groups D, E, and F could be identical, but with concentration of feldspars or muscovite in some layers and variable destruction of feldspar by weathering. Specimen 20 contains much more potassium feldspar and less phyllite than the other samples, but it is not uncommon to find segregations of potassium feldspar in layers in gneiss. It is possible that the potassium feldspar could be weathered; however, the other feldspars in these samples are not greatly weathered, and plagioclase is as susceptible to weathering as potassium feldspar. Thus, specimen 20 came from a different source than 1, 6, 7, and 9, at least on a local scale (perhaps a different wash), but all may have come from widely scattered sources because muscovite-bearing granites and granitic gneisses are common in Arizona.

Specimens 2, 3, 4, 5, 10 (crushed altered andesite(?), Gila Plain(?),
crushed altered andesite(?) with schist, altered andesite(?)
grus, stucco ware)

Specimens 2, 3, and 4 are characterized by a mixture of angular sericite phyllite fragments and peculiar altered clasts with a spotted (with feldspar remnants) appearance that I have been calling "altered feldspar." These altered clasts are possibly altered volcanic fragments in which the glass or matrix is altering more rapidly than the plagioclase crystals. Specimens 2, 3, and 4 also contain red clay lumps or sherd(?), and specimen 3 definitely contains andesite fragments similar to those in 10. Specimen 10, though, is fresher than specimen 3 and contains no phyllite. Specimen 5 is altered, weathered, and ground too thin but has the angular outlines of phyllite and contains the spotted "altered feldspar." Specimen 8 suffers the same defects as 5 and is finer-grained but probably should be included in this grouping. Specimen 5 also contains a number of peculiar opaque lumps, perhaps carbonaceous material, with feldspar inside them.

Specimen 8, 10 (sand (Yuman?), stucco ware)

Careful examination of the "altered feldspars" in specimen 8 discovered one fragment that is indeed trachytic andesite or latite (identified by the composition of plagioclase, which is determined from extinction angles). Some other fragments, however, are probably single feldspar crystals. It is reasonable to say that specimens 8 and 10 (and probably group E, and maybe groups F and G as well) had the same source in part. Nevertheless, the trachytic texture of the feldspars in specimen 10 is distinctive; specimen 10 had a less altered source than 8.

Specimens 11, 12 (Snaketown Red-on-buff (sandy), Snaketown Red-on-buff
(micaceous))

Specimen 11 is derived from a granitic gneiss with common quartzite and feldspar-gneiss fragments. Several percent potassium feldspar crystals are present. While sericite is found in the quartzite and a few single crystals of muscovite are present, it is not abundant. Specimen 12 is similar to 11 in the rock types present and in low degree of alteration and weathering, but it contains noticeably more sericite-muscovite in the quartzite and loose in the matrix as single crystals. Furthermore, specimen 12 has a more variable fragment size than 11 (11 is quite uniform) and contains a few heavily weathered feldspars not present in 11. The matrix of specimen 11 is stained red, and perhaps some muscovite is stained enough to appear to be weathered biotite. Overall, the two slides differ in appearance but the only documentable source fragment difference is the lower muscovite content of specimen 11. In granitic gneisses, however, muscovite content can vary markedly on a scale of centimeters.

Specimens 13, 14 (transitional Santa Cruz/Sacaton Red-on-buff (micaceous), transitional Santa Cruz/Sacaton Red-on-buff (sandy))

Both specimens contain similar muscovite-bearing quartzite and granitic gneiss fragments with rare potassium feldspar crystals. Both also contain similar deep red clay(?) fragments. Specimen 14 contains a volcanic fragment like those in specimen 10.

Specimens 11, 12, 23, 24 (Snaketown Red-on-buff (sandy), Snaketown Red-on-buff (micaceous), Snaketown Red-on-buff, late Snaketown Red-on-buff)

Specimens 12, 23, and 24 are all very similar, even in terms of abundance, sorting, and shape of fragments. As noted above, specimen 11 has a lower muscovite content.

Specimens 13, 14, 21, 22, 25 (transitional Santa Cruz/Sacaton Red-on-buff (micaceous), transitional Santa Cruz/Sacaton Red-on-buff (sandy), transitional Santa Cruz/Sacaton Red-on-buff, early Sacaton Red-on-buff, transitional Santa Cruz/Sacaton Red-on-buff, Aravaipa Variety)

Specimens 13, 14, and 21 are all similar in the sorting and shape of grains, color of the matrix, and presence of dark red clay clasts. Specimen 22 contains similar rock types and has the same texture and red clay inclusions as the others but seems to contain less muscovite. Overall, as pointed out above, the difference between groups D and E (which include all but specimen 25 of this comparative grouping) is probably not significant petrogenetically. The sericite quartzite of specimen 25 produces angular fragments like those in the other samples but seems to have a very fine-grained, uniform foliation and does not appear to be gradational with the coarse feldspars in the gneiss of the other specimens. These could be local variations in the source rock, but 25 can be easily distinguished. Specimen 25 does contain two fragments of trachyte/andesite like those present in specimens 14 and 21.

Specimens 11, 12, 13, 14, 21, 22, 23, 24, 25 (Snaketown Red-on-buff (sandy), Snaketown Red-on-buff (micaceous), transitional Santa Cruz/Sacaton Red-on-buff (micaceous), transitional Santa Cruz/Sacaton Red-on-buff (sandy), transitional Santa Cruz/Sacaton Red-on-buff, early Sacaton Red-on-buff, Snaketown Red-on-buff, late Snaketown Red-on-buff, transitional Santa Cruz/Sacaton Red-on-buff, Aravaipa Variety)

All specimens belong to groups D and E except specimen 25, which has the affinities to group D noted above. The source rock for all could have been a sericite-bearing granitic gneiss with local variations of grain size and of sericite (muscovite) and potassium feldspar content. Several specimens (14, 21, 25) contain andesite fragments. Thus, while detailed petrographic differences exist, all the specimens have the same basic source rock type and could have been (but were not necessarily) produced within meters of each other.

Specimens 16, 17 (Tanque Verde Red-on-brown, Tanque Verde Red-on-brown)

Fragments in both specimens are derived from a similar granitic grus with abundant potassium feldspar, probably quartz monzonite. Specimen 17 is finer-grained than 16 and contains two andesite fragments. In both specimens there are few quartzite fragments; the only sericite present is as alteration of plagioclase.

Specimens 15, 16, 17, 18, 19 (Vamori(?) Red-on-brown, Tanque Verde Red-on-brown, Tanque Verde Red-on-brown, Rillito Red-on-brown, Trincheras Non-specular Purple-on-red)

Specimens 15, 16, and 17 are very similar. Specimen 18 probably had the same source granitic grus, but weathering and sericite alteration of the feldspars and fragments is extensive. Several fragments are definitely altered andesite. Probably specimen 19 had the same source too; its only distinction is a greater content of quartzite, but the feldspar grus and lack of sericite are diagnostic. Specimen 20 is similar to 18 in everything except its content of muscovite.

CONCLUSION

In this analysis, the most reliable differentiation seemed to be the presence or absence of muscovite (called sericite when fine-grained). Because the sample was small, other petrographic factors, such as grain size, degree of weathering, relative abundance of feldspar types, presence of trace minerals (tourmaline, epidote, apatite, zircon), compositional zoning and twinning, and so on, did not prove to be diagnostic. Such parameters can vary widely in mica-bearing granitic gneisses, and man was selective in what he chose for ceramic tempers. In some fragments the trachytic texture produced by many small, aligned plagioclase feldspar crystals was distinctive, but a few such fragments were found in many specimens and were difficult to recognize after alteration. While there are several distinctive rock types represented, most of them seem to be mixed in many specimens.

It is emphasized that the study of several thin sections from the same ceramic vessel would help to alleviate some of the problems mentioned above by providing a more representative sample of each ceramic vessel. Also, as additional petrographic studies are accomplished on ceramic assemblages from various portions of southern Arizona, we can begin to isolate certain key petrographic characteristics of the ceramics from each area. Only then can we hope to understand some of the geological and cultural aspects of prehistoric southern Arizona pottery-making that are hinted at in the results of the present study.

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